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OVERSIGHT HEARING ON THE USE OF OIL DISPERSANTS IN THE DEEPWATER HORIZON OIL SPILL

JOINT HEARING

BEFORE THE

SUBCOMMITTEE ON OVERSIGHT

AND THE

COMMITTEE ON
ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE

ONE HUNDRED ELEVENTH CONGRESS

SECOND SESSION

AUGUST 4, 2010

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C O N T E N T S

Page

AUGUST 4, 2010

OPENING STATEMENTS

Boxer, Hon. Barbara, U.S. Senator from the State of California 1
Inhofe, Hon. James M., U.S. Senator from the State of Oklahoma 2
Whitehouse, Hon. Sheldon, U.S. Senator from the State of Rhode Island 4
Carper, Hon. Thomas R., U.S. Senator from the State of Delaware 5
Barrasso, Hon. John, U.S. Senator from the State of Wyoming 7
Lautenberg, Hon. Frank R., U.S. Senator from the State of New Jersey 8
Cardin, Hon. Benjamin L., U.S. Senator from the State of Maryland, prepared statement 116
Gillibrand, Hon. Kirsten, U.S. Senator from the State of New York, prepared statement 117

WITNESSES

Anastas, Paul, Assistant Administrator, Office of Research and Development, U.S. Environmental Protection Agency 10
Prepared statement 12
Responses to additional questions from Senator Boxer 20
Response to an additional question from:
Senator Carper 22
Senator Sanders 22
Responses to additional questions from:
Senator Gillibrand 22
Senator Inhofe 26
Westerholm, David, Director, Office of Response and Restoration, National Ocean Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce 29
Prepared statement 31
Responses to additional questions from Senator Boxer 40
Response to an additional question from Senator Sanders 44
Responses to additional questions from:
Senator Gillibrand 44
Senator Inhofe 46
Kendall, Ronald J., Ph.D., Director, the Institute of Environmental and Human Health, and Professor and Chairman, Department of Environmental Toxicology, Texas Tech University 66
Prepared statement 69
Responses to additional questions from:
Senator Boxer 76
Senator Sanders 79
Senator Inhofe 82
Smith, David C., Ph.D., Professor and Associate Dean, Graduate School of Oceanography, University of Rhode Island 85
Prepared statement 87
Responses to additional questions from Senator Boxer 89
Response to an additional question from:
Senator Sanders 90
Senator Inhofe 90
Overton, Edward B., Ph.D., Professor Emeritus, Louisiana State University Department of Environmental Sciences, School of the Coast and Environment 92

Page

Overton, Edward B., Ph.D., Professor Emeritus, Louisiana State University Department of Environmental Sciences, School of the Coast and Environment—Continued
Prepared statement 94
Response to an additional question from Senator Sanders 98
Responses to additional questions from Senator Inhofe 99
Savitz, Jacqueline, Senior Campaign Director, Oceana 101
Prepared statement 103

OVERSIGHT HEARING ON THE USE OF OIL DISPERSANTS IN THE DEEPWATER HORIZON OIL SPILL

WEDNESDAY, AUGUST 4, 2010

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
SUBCOMMITTEE ON OVERSIGHT,
Washington, DC.

The Committees met, pursuant to notice, at 10 a.m. in room 406, Dirksen Senate Office Building, Hon. Sheldon Whitehouse (Chair of the Subcommittee) presiding.

Present: Senators Whitehouse, Boxer, Inhofe, Lautenberg, Carper, and Barrasso.

OPENING STATEMENT OF HON. BARBARA BOXER, U.S. SENATOR FROM THE STATE OF CALIFORNIA

Senator BOXER. Thank you so much.

I want to thank Chairman Whitehouse for his excellent leadership of the Oversight Subcommittee. And this hearing is part of the Environment and Public Works oversight of the Federal Government's response to the Deepwater Horizon disaster.

Today we will be examining the issues surrounding the use of chemical dispersants in dealing with the Deepwater spill, which we now know is the largest of its kind in history, totaling an estimated $4.9 million barrels of crude oil—more than 200 million gallons. As of August 3, 2010, the Unified Command reports that BP has used an extraordinary quantity of dispersants in dealing with the Gulf spill—1.8 million gallons altogether, including 1.1 million gallons applied on the surface and almost 780,000 gallons beneath the surface of the sea.

Dispersants work like detergents, breaking up oil into smaller droplets which may end up suspended in the water column beneath the surface. While this massive application of dispersants was carried out in the hopes of protecting the shoreline from oil slicks, it does raise serious questions about short- and long-term impacts on the environment and about unintended consequences.

For example, while dispersants may have been applied in the hope of reducing the effects of heavy oil slicks on shorelines and wildlife, more needs to be done to fully understand the impact that dispersants and dispersed oil are having beneath the surface. These decisions have very real consequences, not just for fish and wildlife that inhabit the Gulf but for the fishermen and the oystermen and others whose livelihoods and families depend on the long-term health of the Gulf of Mexico.

Questions have also been raised about the process the incident command and Federal agencies used for approving dispersant use. Our witnesses today will address what we know about dispersants, what we have learned over the past 3 months since the start of the disaster. Just as important, they will speak to what we do not yet know about dispersants in oil and what we need to do to find the answers.

This Committee has already approved important legislation, sponsored by Senator Shaheen, to support greater investments in research on oil spills and spill response. More remains to be done. Today's hearing is an important step in getting answers to the questions raised by this unprecedented disaster. And since we have a joint hearing, full Committee and the Subcommittee, and I have asked Senator Whitehouse to chair it, I will turn back to him.

Senator WHITEHOUSE. I will yield to the Ranking Member.

OPENING STATEMENT OF HON. JAMES M. INHOFE, U.S. SENATOR FROM THE STATE OF OKLAHOMA

Senator INHOFE. All right, for an opening statement. Thank you, Mr. Chairman, for scheduling today's hearing. I think this is significant, on the use and impacts of the oil dispersants to mitigate the BP oil spill.

Following the tragic *Exxon Valdez* oil spill, the National Contingency Plan was updated to address new issues that might arise in the event of an oil spill of national significance. I remember that well, and I remember being up there at the time, 20 years ago, when that happened.

Among other things, the NCP was amended to require a pre-approved list of dispersants deemed safe for emergency use by the Environmental Protection Agency. By creating a pre-approved list, oil spill responders have an effective tool to fight the devastating effects of an oil spill quickly and without bureaucratic delay.

Let me be clear: nobody is advocating for the use of dispersants unless they are absolutely necessary. But with the BP disaster, they appear to be the lesser of two evils. I am disappointed that this important tool, which was first approved for use by the EPA, then-Administrator, Carol Browner, in 1994, was implemented in fits and starts. The EPA first approved, then stopped, then approved again the use of dispersants.

I am concerned that the EPA's back and forth, which runs counter to having a list of approved prior to the emergency, may have exasperated the damages caused by the BP spill. The Administration's are somewhat baffling, considering top officials have clearly stated that dispersants are safe and effective. Carol Browner, now President Obama's energy and climate change czar, has been quoted comparing dispersants to dish soap and just last week said, "We have been using dispersant. We do monitor, the EPA monitors regularly. Right now, they are not seeing anything of concern. NOAA is also monitoring. They are not seeing anything of concern, and right now the monitoring is telling us that everything is OK. But we will continue to monitor."

EPA Administrator Lisa Jackson said, "We know that dispersants are less toxic than oil and that they break down over a period of weeks, rather than remaining for several years as untreated oil might." In a report last Tuesday, the NOAA Administrator stated, "The light crude oil is biodegrading quickly. We know that a significant amount of oil has dispersed and been biodegraded by naturally occurring bacteria."

The current dispersant being used was formulated following the *Exxon Valdez* spill and approved by the EPA for use in 1994. This dispersant is currently approved for use in 28 countries, and 30 groups have access to samples as well as complete access to its ingredients and mixtures. These groups include 16 academic institutions, multiple Federal agencies, including numerous divisions in regions of EPA, and five departments within the State government of Louisiana.

Legislation covering dispersants has now been introduced in the Senate and passed in the House. The House-passed language institutes a 2-year moratorium on dispersants and requires full public disclosure of ingredients. This would greatly limit our ability to respond to any potential future spills, and could drastically diminish our domestic manufacture and supply of dispersants in the future.

Clearly, there are uncertainties due to the volume and method of use of dispersants in this current response effort. But we must be measured in how we address these uncertainties, because we could ultimately do more harm than good.

I applaud Senator Lautenberg's efforts in drafting a more reasoned alternative to the House bill. At this point, based on the extensive Federal research on dispersants initiated after the BP spill, I am not sure if Senator Lautenberg's legislation is needed.

I also have some additional concerns with aspects of the bill, but will continue to study the issue. I commit today to work with Senator Lautenberg on a bipartisan legislation and the need for it.

So thank you very much, Mr. Chairman.

[The prepared statement of Senator Inhofe follows:]

STATEMENT OF HON. JAMES M. INHOFE,
U.S. SENATOR FROM THE STATE OF OKLAHOMA

Thank you, Madam Chair, for scheduling today's important hearing to examine the use and impacts of oil dispersants to mitigate the BP oil spill. Following the tragic *Exxon Valdez* oil spill, the National Contingency Plan (NCP) was updated to address new issues that might arise in the event of an oil spill of national significance. Among other things, the NCP was amended to require a pre-approved list of dispersants deemed safe for emergency use by the Environmental Protection Agency. By creating a pre-approved list, oil spill responders have an effective tool to fight the devastating effects of an oil spill quickly and without bureaucratic delay.

Let me be clear: nobody is advocating for the use of dispersants unless they are absolutely necessary, but with the BP disaster they appear to be the lesser of two evils. I am disappointed that this important tool—which was first approved for use by EPA and then-Administrator Carol Browner in 1994—was implemented in fits and starts. EPA first approved—then stopped—then approved again the use of dispersants. I am concerned that EPA's back and forth—which runs counter to having a list approved prior to an emergency—may have exacerbated the damages caused by the BP spill.

The Administration's actions are somewhat baffling considering top officials have clearly stated that dispersants are safe and effective. Carol Browner, now President Obama's Energy and Climate Change Czar, has been quoted comparing dispersants to dish soap and just last week said, "We have been using dispersant. We do monitor; the EPA monitors regularly. Right now they're not seeing anything of concern. NOAA is also monitoring. They're not seeing anything of concern, and right now the monitoring is telling us that everything is OK, but we will continue to monitor." EPA Administrator Lisa Jackson said, "We know that dispersants are less toxic than oil," and that they "break down over a period of weeks, rather than remaining for several years as untreated oil might." In a report last Tuesday, NOAA Administrator Jane Lubchenco said, "The light crude oil is biodegrading quickly . . . we know that a significant amount of the oil has dispersed and been biodegraded by naturally occurring bacteria."

The current dispersant being used, Corexit 9500, was formulated following the *Exxon Valdez* spill and approved by EPA for use in 1994. This dispersant is currently approved for use in 28 countries, and 30 groups have access to samples as well as complete access to its ingredients and mixtures. These groups include 16 academic institutions, multiple Federal agencies, including numerous divisions and regions of EPA, and 5 departments within the State government of Louisiana. Legislation covering dispersants has now been introduced in the Senate and passed in the House. The House-passed language institutes a 2-year moratorium on dispersants and requires full public disclosure of ingredients. This would greatly limit our ability to respond to any potential future spills and could drastically diminish our domestic manufacture and supply of dispersants in the future.

Clearly there are uncertainties due to the volume and method of use of dispersants in this current response effort. But we must be measured in how we address these uncertainties because we could ultimately do more harm than good. I applaud Senator Lautenberg's efforts in drafting a more reasoned alternative to the House bill. At this point, based on the extensive Federal research on dispersants initiated after the BP spill, I'm not sure if Senator Lautenberg's legislation is needed. I also have some additional concerns with aspects of the bill but will continue to study this issue, and I commit today to work with Senator Lautenberg on bipartisan legislation if there's a need for it.

Thank you.

OPENING STATEMENT OF HON. SHELDON WHITEHOUSE, U.S. SENATOR FROM THE STATE OF RHODE ISLAND

Senator WHITEHOUSE. Chairman Boxer, Ranking Member Inhofe, thank you for holding this joint hearing.

When the Deepwater Horizon oil rig exploded, it took 11 lives and triggered a chain of events that have led to what may be the largest and most destructive environmental disaster in our history. Thankfully, after 3 long months of oil continuously geysering from the depths of the Gulf, a temporary cap stemmed the flow, and it appears that the well is now on its way to being killed.

But we are by no means through this disaster. At the surface, oil continues to lap at the shores of the Gulf. Oil continues to travel with the current to convergence zones in the Gulf, where it concentrates in areas scientists refer to as Sargasso seaweed beds, areas where sea life is most abundant. It continues to coat and kill diving birds and marine mammals.

In something of a grand experiment, 1.8 million gallons of dispersant was used to break up the oil into smaller particles to increase the surface area of the oil and facilitate the natural degradation and digestion of the oil. Approximately 40 percent was applied in a totally unprecedented manner: at depth, 1 mile below the surface of the Gulf water, at the wellhead. This was done so that the oil would never reach the surface, or if it did, it would do so in a dispersed and less visible form.

The subsurface application of dispersants is why we are seeing less oil on the surface of the Gulf than we expected. However, it is unclear if this will limit the damage from the spill or cause even greater harm. We are now seeing large quantities of oil present in the water column, and it could already be starting to settle onto the sea floor. We don't know yet what effect this could have on the Gulf ecosystem from the plankton that form the base of the food chain on up to the apex species, including the bluefin tuna and the sperm whale.

Two types of chemical dispersant have been used in response to this spill. One dispersant, Corexit 9527, was identified as highly toxic about 1 month into its use. When EPA asked BP to identify less toxic alternatives, BP responded that these were the most effective dispersants available and that very little was known about the relative toxicity of alternatives.

EPA then took on the task to analyze the available alternatives. That analysis was completed yesterday, 3 months after the spill began. While this was a necessary undertaking, it is regrettable that this analysis was not available before the spill began. We still know very little about the long-term ecological impact of using so much dispersant on top of so much oil. Whether to use dispersants, which dispersants to use, when to use them, these are all difficult decisions, and more difficult when made on the fly and without prior review from agencies responsible for protecting our health and natural resources.

I look forward to hearing the testimony of NOAA and EPA and of the scientists and policymakers on our second panel. In particular, I want to thank and welcome Dr. David Smith from the Graduate School of Oceanography of the University of Rhode Island, for being here. My wife is a graduate of the Graduate School of Oceanography. I can remember lugging buckets of saltwater around those labs as a young man, helping her with her experiments.

Senator CARPER. Was that part of the courtship?

[Laughter.]

Senator WHITEHOUSE. The key part, actually, was the winter diving. I wasn't as up for that as you might expect.

[Laughter.]

Senator WHITEHOUSE. But I did it. When that wetsuit first fills, it is mighty chilly in February on Narragansett Bay. It is remarkable what one will do for love.

[Laughter.]

Senator WHITEHOUSE. Anyway, I look forward to a frank discussion about the consequences of dispersant use and how to improve the dispersant approval regime. We owe this to the communities along the Gulf Coast, but we also owe it to all Americans to assure them that we are prepared the next time such a disaster strikes.

And again, I thank my colleagues on the Committee and the Subcommittee.

Senator Carper.

OPENING STATEMENT OF HON. THOMAS R. CARPER, U.S. SENATOR FROM THE STATE OF DELAWARE

Senator CARPER. Thank you, Mr. Chairman. My thanks to both you and Senator Boxer for holding the hearing. I want to thank our witnesses for coming today and for your testimony and your responses to our questions.

I have mentioned before, we try to start all these hearings on this subject just by again expressing our heartfelt sorrow to those who have lost loved ones and families that are suffering from the loss of their loved ones in this terrible accident and also to just say that our hearts are filled for those who live in the Gulf, who work in the Gulf and whose livelihoods, whose lives have been in many cases disrupted or turned on their heads.

With that having been said, I come from a coastal State, a little coastal State in the mid-Atlantic. I think I understand many be better than some folks who live in the middle part of this country what the importance is for shorelines to our economy, not just to Delaware's economy, but to our Nation's economy.

Our oceans, whether the Atlantic or the Pacific or others, our oceans and our shores give life to many industries, to tourism, to recreation and the fishing industry, transportation, construction, research, education, real estate, many, many more. So we all have to work together to make sure that the laws and regulations we have in place protect these critical industries and our lives from harm in a fair and a real way.

One of the lessons that I have learned as a Chair of the Subcommittee on Clean Air and Nuclear Safety, where we oversee the Nuclear Regulatory Commission, is the importance of effective regulatory oversight to ensure that we avoid future accidents in the first place. And through strong oversight and research I hope we can develop greener, more effective response measures going forward.

With the unprecedented amount of oil that has leaked and the unprecedented efforts to clean up the oil, safeguarding public health and the health of our ecosystem is a very real concern. Despite the best efforts of our Nation's best environmental scientists, some of whom are here today, to help us understand the environmental impacts of this spill. The reality is that we do not know and we may not know for some time the long-term effects of this disaster.

Specifically, I look forward today to hearing more from our witnesses about the EPA's efforts to oversee the deployment of chemical dispersants currently being used to clean up oil in the Gulf. On the one hand, our understanding is that the impact of oil on our shores would have been much greater without the dispersants. On the other hand, much is still unknown about the impacts of these dispersants over the long-term health of our marine environment.

I want to hear from our talented and distinguished scientists we have assembled today what their best understanding is of the impact that those underwater dispersants are having on marine life as well as their potential impact on human health. While I firmly believe that we must use all resources at our disposal to mitigate the efforts of this disaster, I feel strongly that we must do so prudently and with the best information that is at our disposal.

Today I hope we will discuss what steps the Federal Government can take to minimize the damage of the spill, to avoid an accident like this from occurring again in the first place through effective regulatory oversight, and to ensure the safe and effective use and advancement of tools that are at our disposal, or that will come to be at our disposal in the future as we seek to clean up this spill and any that may occur in the future.

Thank you, Mr. Chairman.

[The prepared statement of Senator Carper follows:]

STATEMENT OF HON. THOMAS R. CARPER, U.S. SENATOR FROM THE STATE OF DELAWARE

I want to thank the Chairman for holding this hearing today and thank the witnesses for participating.

As I have mentioned before, our hearts go out to the folks impacted by this terrible accident—to the families of the 11 workers that died and those that were injured.

And our hearts also go out to the thousands of workers, individuals, and families in the Gulf of Mexico who depend on the Gulf's waters and shores for their economic livelihood.

As a member from a coastal State, I understand well the importance of our shorelines to our local and national economies.

Our oceans and shores give life to many industries: tourism and recreation, the fishing industry, transportation, construction, research and education, real estate, and many more.

And so we must work to make sure that the laws and regulations that we have in place protect these critical industries from harm in a fair and real way.

One of the lessons that I have learned as Chairman of the Subcommittee on Clean Air and Nuclear Safety, where I oversee the Nuclear Regulatory Commission, is the importance of effective regulatory oversight to ensure that we avoid future accidents in the first place.

Through strong oversight and research I hope we can develop greener, more effective response measures going forward.

With the unprecedented amounts of oil leaked and the unprecedented efforts used to clean up the oil, safeguarding public health and the health of our ecosystems is a very real concern.

Despite the best efforts of our Nation's best environmental scientists—some of whom are here today—to help us understand the environmental impacts of this spill, the reality is that we do not know—and we may not know for years to come—the long-term effects of this disaster.

Specifically, I look forward today to hearing more about the EPA's efforts to oversee the deployment of chemical dispersants currently being used to clean up the oil in the Gulf.

On one hand, my understanding is that the impact of oil on our shores would have been much greater without dispersants. On the other hand, much is still unknown about the impacts of these dispersants over the long-term.

I want to hear from the talented and distinguished scientists we have assembled what their best understanding is of the impact that these underwater dispersants are having on our marine life, as well as their potential impact on human health.

While I firmly believe that we must use all the resources at our disposal to mitigate the effects of this disaster, I feel strongly that we must do so prudently and with the best information at our disposal.

Today, I hope we will discuss what steps the Federal Government can take to minimize the damage of this spill, to prevent an accident from occurring again in the first place through effective regulatory oversight, and to ensure the safe and effective use and advancement of tools at our disposal to clean up the oil.

Senator WHITEHOUSE. Senator Barrasso, my Ranking Member on the Subcommittee.

OPENING STATEMENT OF HON. JOHN BARRASSO, U.S. SENATOR FROM THE STATE OF WYOMING.

Senator BARRASSO. Thank you very much, Mr. Chairman. I thank our guests for being here today.

The ecological fallout of the oil spill in the Gulf is not yet fully understood. There was a front page story in the New York Times today above the fold, U.S. Report, says the oil that remains is scant new risk, concern still exists, 26 percent of spill is left but is seen as diluted and breaking down. So we still don't fully understand the fallout of the oil spill in the Gulf.

Clearly, we do need to thank those who responded for their hard work in the Gulf. The responders in the Gulf were faced with a choice. On the one hand, they could allow millions of gallons of oil to pollute the beaches and the marshes and the wetlands. This would include the potential devastation of the wildlife in the area. It would also include hurting jobs in the fishing and tourism industry and in the towns that depend on those same industries to provide a tax base from which to pay for schools and for emergency services.

On the other hand, the responders could choose to use approved chemical dispersants to break down the oil so bacteria could deal with the problem and prevent some of those tragic consequences from occurring. The amount of dispersant they would need to use would be unprecedented. But the dispersant at their disposal had been approved by the Clinton administration's Environmental Protection Agency in 1994. Responders knew the use of dispersants to address massive oil spills is a well-documented practice. So responders chose the latter. And I think they made the right choice.

But don't take my word for it. In terms of the choice between using dispersants and allowing oil to devastate the Gulf's economy, beaches, and habitat, White House Press Secretary Robert Gibbs said, "I think far and away the most harmful substance that is being emitted into the environment in the Gulf is the oil." EPA Administrator Lisa Jackson agreed when she said, "This spill is an emergency in every sense of the word, and dispersants are one tool in the situation that could not be more urgent."

The Wall Street Journal on August 2nd also quoted an EPA statement that said that the Agency "believes dispersant use has been an essential tool in mitigating the spill's impact." And even Admiral Thad Allen of the U.S. Coast Guard called this a legitimate alternative. He says that a legitimate alternative to the dispersant has not surfaced yet.

So I would suggest that those who criticize the use of dispersants are the same people who cannot offer one alternative to the use of dispersants in this situation. They leave responders with a Catch–22: either you are blamed for dumping chemicals in the Gulf or you allow the oil to devastate the Gulf. Some who criticize the use of dispersants want to over-regulate the use of them. There is no proven need for such an action at this time. In fact, the sponsors of such legislation have language included in their bill that has the EPA do "an assessment of the adequacy of existing Federal laws."

If there are truly lessons to be learned from the response to this spill, let's learn them. However, legislating new dispersant regulations before we even know how existing law is working does not make sense to me. It would only serve to create more regulations and slow the response to any future spills.

I thank you, Mr. Chairman, and look forward to hearing the testimony.

Senator WHITEHOUSE. Senator Lautenberg.

OPENING STATEMENT OF HON. FRANK R. LAUTENBERG, U.S. SENATOR FROM THE STATE OF NEW JERSEY

Senator LAUTENBERG. Thanks, Mr. Chairman.

I first want to say thank you to Senator Inhofe, for his willingness to examine the possibilities of the dangers and risks associated with the dispersants and see what we ought to do about it.

Added to the woes and the horror of the largest accidental oil spill in the history of the world, oil pouring into the Gulf of Mexico, BP rushed in to apply chemical dispersants in order to break the oil slicks into small droplets. To date, BP has applied almost 2 million gallons of chemical dispersants to deal with the Deepwater disaster. Never before have we seen dispersants used on this scale.

It is no wonder that EPA issued a directive on May 19th for BP to find less toxic alternatives to the oil company's choice of dispersants. However, BP said there wasn't enough long-term testing data available on dispersants to know which ones were safer to use. So they kept using the same dispersants.

The truth is, with only minimal toxicity data available, and no requirements for full disclosure of ingredients, the damage these dispersants could cause to the environment, marine life, and potentially people, remains a mystery. That is why last week I introduced the Safe Dispersant Act. This common sense bill requires long-term testing of dispersants, which is critical to understanding the full range of their health effects.

If a dispersant cannot meet minimum toxicity standards, then the dispersant should not be used on an oil spill. My bill also protects the public's right to know by requiring the disclosure of all ingredients that make up a dispersant.

The bill is endorsed by over 30 health and environmental groups, including the Environmental Defense Fund, Natural Resources Defense Council, and Oceana, to name a few. I ask unanimous consent that their letter of support be inserted into the record.

Senator WHITEHOUSE. Without objection, so ordered.

[The referenced material was not received at time of print.]

Senator LAUTENBERG. EPA Administrator Lisa Jackson has also stated that the law needs to be changed to provide more information on the safety of dispersants. Almost everyone agrees that current law is inadequate; that is everyone except Rush Limbaugh. Earlier this week we heard him say that Mother Nature can handle the dispersants. It is callous, irresponsible, and I doubt that families in the area are willing to wait and see to find out whether or not there is any risk in the distribution of these dispersants.

The fact is relief workers and wildlife in the Gulf have become unwitting participants in a dangerous science experiment. There are enough warning signs about the risks of the dispersants to know that we need more thorough testing. For example, my State, the State of New Jersey, and by the way, I note that here I sit with two colleagues to the right of me and that we are the largest State. It is a very comforting feeling.

We have to do more thorough testing. In my State, New Jersey, classifies one of the chemicals used in Gulf dispersants as a serious health hazard because of its potential to cause cancer, liver and kidney damage, and reproductive problems. So Mr. Chairman, I hope we can move quickly. This was an excellent idea by the Chairman of the full Committee and yourself to get moving on this. I hope we can move quickly enough to require better testing and shine some light on these dispersants once and for all and lift the veil of mystery that surround it.

Thank you.

Senator WHITEHOUSE. Thank you, Senator Lautenberg.

Our first witness is Dr. Paul Anastas. He is the Director of the Office of Research and Development at the United States Environmental Protection Agency. He has extensive previous experience, including a role in the White House at the Office of Science and Technology Policy as the Assistant Director for the Environment from 1999 to 2004.

We welcome here, and look forward to your testimony, Dr. Anastas.

STATEMENT OF PAUL ANASTAS, ASSISTANT ADMINISTRATOR, OFFICE OF RESEARCH AND DEVELOPMENT, U.S. ENVIRONMENTAL PROTECTION AGENCY

Mr. ANASTAS. Thank you very much, Chairman Boxer, Ranking Member Inhofe, Senator Whitehouse, members of the Committee. Thank you for having me here to testify about dispersants and their use in the BP Deepwater Horizon crisis.

We have now passed day 100 of the BP oil spill tragedy, a tragedy that resulted in loss of life, livelihood, and put our most precious ecosystems in peril. We are relieved that the well is currently sealed and that dispersant use has been reduced to zero. We hope and expect this will continue to be the case.

However, the tragedy does not end with the sealing of the well. The President and the EPA are committed to the long-term recovery and restoration of the Gulf Coast, one of our most precious ecosystems.

In addition to its other responsibilities with spill response, EPA continues to rigorously monitor air, water, and sediments for the presence of dispersants and crude oil components that could have an impact on health or the environment. This data is posted on EPA's Web site and is publicly available.

EPA has a role with the use of dispersants, which are chemicals that are applied to the oil to break it down into small droplets. The dispersed oil mixes into the water column and is rapidly diluted and degraded by bacteria and other microscopic organisms.

Specifically, EPA is responsible for managing the product schedule of dispersants available for use in oil spill response. When considering dispersant use, we are faced with environmental tradeoffs. The long-term effects on aquatic life are still significantly unknown. And BP has used over 1.8 million gallons of dispersant, a volume never before used in the United States.

But what we do know right now is this. We aren't seeing dispersants in our monitoring results. There have been thousands of samples, both near shore and offshore. And we are not seeing the dispersants away from the wellhead. Thus far both monitoring data and modeling data shows that the dispersants are not persistent in the environment. Dispersants are not depleting oxygen in the water to dangerous levels.

Now, given the unprecedented nature of the spill, the EPA directed BP to identify less toxic alternative dispersants. When the company failed to provide this information, EPA decided to conduct this testing independently, in a rigorous, peer-reviewed manner. Specifically, EPA conducted acute toxicity tests to determine lethal concentrations of eight available dispersants. First, we tested each of the eight dispersants alone. Then we tested the Louisiana sweet crude oil alone. Finally, we tested the mixture of the oil and the dispersants.

Each standard test screened a species known as mysid shrimp and silverside fish to determine the relative hazard of each of these dispersants. These two species are widely considered to be representative of those found in the Gulf and were tested during the juvenile life stage when organisms are sensitive to pollutant stress.

The tests were conducted over a range of concentrations, including those much greater than what aquatic life is generally expected to encounter in the Gulf. EPA's testing delivered three important results. One, all of the dispersants were tested alone, can be categorized as slightly toxic to practically non-toxic. Two, the oil alone was generally moderately toxic. Three, mixtures of oil in each of the eight dispersants were no more toxic than the oil alone.

All of these results indicate that the eight dispersants tested possess roughly similar acute toxicities.

While these data are important, I want to emphasize that continued monitoring is absolutely necessary. EPA has directed BP to monitor for indicators of environmental stress like decreased dissolved oxygen levels and increased toxicity to small organisms called rotifers. To date, we have not seen dissolved oxygen levels approach levels of concern to aquatic life. We have also seen no excessive mortality in rotifers.

While more work needs to be done, we see that the dispersants are working to help keep the oil off our precious shoreline and away from sensitive coastal ecosystems. To date, EPA monitoring has not found dispersant chemicals in water or sediment near the coasts or wetlands.

The crisis has made it evident that additional research is needed. Congress has recently appropriated EPA $2 million to begin long-term study on the impacts of dispersants. These funds will support research on the short- and long-term environmental and human health impacts associated with the oil spill and dispersant use.

We will also further our research efforts to include innovative approaches to spill remediation and to address the mechanisms of environmental fate, effects, and transport of dispersants.

EPA will continue to take a science-based approach to dispersant use. We will continue monitoring, identifying and responding to public health and environmental concerns, including waste management and beach clean up and coordination with our Federal, State and local partners. EPA is committed to protecting the Gulf Coast communities from adverse environmental effects of the Deepwater Horizon oil spill.

In conclusion, we will persist in asking the hard questions until we more fully understand the long-term effects of the BP oil spill and conduct investigations required to enable the Gulf's long-term recovery. EPA is fully committed to working with the people of the Gulf Coast, our Federal partners, the scientific community, and NGOs toward the recovery of the Gulf of Mexico and the restoration of that precious ecosystem.

At this time, I will welcome any questions you may have.

Thank you.

[The prepared statement of Mr. Anastas follows:]

TESTIMONY OF
PAUL ANASTAS, PhD
ASSISTANT ADMINISTRATOR FOR THE
OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY

BEFORE THE
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE

August 4, 2010

Madam Chairman, Ranking Member Inhofe, and Members of the Committee, thank you for the opportunity to testify on the role of the U.S. Environmental Protection Agency (EPA) in the use of dispersants in the Deepwater Horizon oil spill response. My testimony today will provide an overview of EPA's role and activities in the affected Gulf Coast region following the April 20, 2010 Deepwater Horizon explosion and resulting oil spill. I will also discuss EPA's latest findings on the toxicity of dispersants used in the Gulf that were released earlier this week.

Oil Spill Response

The National Contingency Plan (NCP) is the federal government's blueprint for responding to both oil spills and hazardous substance releases. Additionally, it provides the federal government with a framework for notification, communication, and responsibility for oil spill response. Under the NCP, the EPA or the United States Coast Guard (USCG) provide federal On-Scene Coordinators (FOSCs) for the inland and coastal zones, respectively, to direct or oversee responses to oil spills. The exact lines between the inland and coastal zones are determined by Regional Response Teams (RRTs) and established by Memoranda of Agreement

(MOAs) between regional EPA and USCG offices. USCG is the FOSC for the Deepwater Horizon oil spill response.

Other federal agencies with related authorities and expertise may be called upon to support the FOSC. The NCP established the National Response Team (NRT), comprised of fifteen federal agencies, to assist responders by formulating policies, providing information, technical advice, and access to resources and equipment for preparedness and response to oil spills and hazardous substance releases. EPA serves as chair of the NRT and the USCG serves as vice-chair.

In addition to the NRT, there are thirteen RRTs, one for each of EPA's ten regional offices and one each for Alaska, the Caribbean, and the Pacific Basin. RRTs are co-chaired by each EPA Region and its USCG counterpart. The RRTs are also comprised of representatives from other federal agencies and state representation, and frequently assist the FOSCs who lead spill response efforts. The RRTs help OSCs in their spill response decision making, and can help identify and mobilize specialized resources. For example, through the RRT, the FOSC can request and receive assistance on natural resource issues from the Department of the Interior (DOI), the Department of Commerce, and the States, or borrow specialized equipment from the Department of Defense or other agencies. Involvement of the RRT in these response decisions and activities helps ensure efficient agency coordination while providing the FOSC with the assistance necessary to conduct successful spill response actions.

Under the NCP, authority to use dispersants rests with the FOSC but requires concurrence of certain RRT members. For example, RRT representatives from EPA, DOI, the Department of Commerce's National Oceanic and Atmospheric Administration (NOAA), and the states with jurisdiction over the navigable waters under consideration may pre-authorize application of approved dispersant products so that the FOSC can authorize dispersant use without obtaining further concurrences.

EPA is also responsible for maintaining the NCP Product Schedule, which lists chemical and biological products available for federal OSCs to use in spill response and cleanup efforts. Due to the unique nature of each spill, and the potential range of impacts to natural resources, FOSCs help determine which products, if any, should be used in a particular spill response. If the application of a product is pre-authorized by the RRT, then the FOSC may decide to use the product in a particular response. If the product application does not have pre-authorization from the RRT, then the FOSC must obtain concurrence from the EPA representative and the representatives of states with jurisdiction over the navigable waters under threat. In addition, the FOSC must consult with representatives of DOI and NOAA, as natural resource trustee agencies before authorizing incident-specific use of a dispersant.

Use of Oil Dispersants in the Gulf

In order to ensure consensus on the use of dispersant, the USCG, as the Federal On-Scene Coordinator, in consultation with EPA, DOI, NOAA, and the State of Louisiana, authorized BP to apply dispersants on the water surface to mitigate the shoreline impacts on fisheries, nurseries, wetlands and other sensitive environments. Dispersants contain a mixture of chemicals, that, when applied directly to the spilled oil, can disperse oil into smaller drops that mix vertically and horizontally in the water column. Microscopic organisms are then able to act rapidly to degrade oil within the droplets.

The application of dispersant is part of a broader environmental response strategy to minimize environmental impacts. The spill management strategies, practices, and technologies that have been implemented include containment, mechanical removal techniques (booming and skimming operations), *in-situ* burning, and dispersant use. Environmental tradeoffs are associated with the widespread use of large quantities of dispersant. However, dispersants are generally less toxic than oil; they reduce risks to shorelines, and degrade quickly over several days to weeks, according to modeling results.

In addition, the use of dispersants at the source of the leak represents a novel approach to addressing the significant environmental threat posed by the spill. Due to the unprecedented nature of this event in which oil was continuing to spill into the Gulf from the wellhead, the USCG, as the Federal On-Scene Coordinator, in consultation with an activation of the full RRT and EPA, approved subsurface dispersant application. This approval was contingent on rigorous, constant monitoring for potential environmental effects, as recommended by EPA. Subsurface use of the dispersant is believed to have been effective at reducing the amount of oil reaching the surface and has also resulted in significant reductions in total amount of dispersants used.

On May 10, 2010, EPA and USCG issued a directive requiring BP to implement a monitoring and assessment plan for both subsurface and surface applications of dispersants. Additionally, on May 26, 2010, EPA and USCG directed BP to significantly decrease the overall volume of dispersant used. In the month following the directive, the total volume of dispersants used fell by 75% from their peak levels.

We have now passed the 100th day of the oil spill tragedy. We are relieved that the well was capped and sealed on July 15 and that no dispersant has been applied since July 19. We hope and expect that this will continue to be the case. However, this tragedy does not end with the sealing of the well. The President and the EPA are committed to the long-term recovery and restoration of the Gulf Coast, one of our most precious ecosystems. EPA continues to rigorously monitor the air, water, and sediments for the presence of dispersants and crude oil components that could have an impact on health or the environment. All monitoring information and data are posted on EPA's website at: http://www.epa.gov/bpspill/.

EPA Releases Toxicity Testing Data for Eight Oil Dispersants

Because of the unprecedented volumes of dispersant being used in this spill and because much is unknown about the underwater use of dispersants, Addendum 2 to the May 10, 2010 directive required BP to determine whether a less toxic, equally effective product was available. When the company failed to provide this information, EPA began its own scientific testing of eight dispersant products on the National Contingency Plan Product Schedule to confirm the accuracy of the data being provided by the manufacturers and to make the best informed decision on appropriate dispersant use. As part of an overall assessment of BP's use of Corexit 9500A, EPA conducted toxicity tests with mysid shrimp and silverside fish to ensure that the response proceeds in a cautious and protective manner in determining the relative hazard of pollutants.

EPA initiated testing to ensure that decisions about ongoing dispersant use in the Gulf of Mexico continue to be grounded in the best available science and data. This includes screening tests to assess cytotoxicity (cell death), endocrine activity, and acute toxicity of eight available dispersants. *In vitro* assays were used to test the degree to which these eight dispersants are toxic to various types of mammalian cells. EPA also tested the potential for each dispersant to exhibit endocrine activity because some of the dispersants include nonylphenol ethoxylates (NPE). NPE breaks down in the environment to nonylphenol (NP), a substance that could potentially cause endocrine disruption. On June 30, 2010, EPA released the results of the initial round of toxicity testing that showed that two dispersants showed a weak signal in one of the four estrogen receptor (ER) assays, but integrating over all of the ER and androgen receptor (AR) results these data do not indicate that any of the eight dispersants display biologically significant endocrine activity via the androgen or estrogen signaling pathways. None of the dispersants triggered cell death at the concentrations of dispersants expected in the Gulf.

EPA also conducted acute toxicity tests on mysid shrimp and silverside fish to determine lethal concentrations of the eight dispersants alone, the Louisiana Sweet Crude oil alone, and a mixture of the Louisiana Sweet Crude oil with each of the eight dispersants. These are coastal species found in the Gulf and were tested during a juvenile life stage, when organisms are even more sensitive to pollutant stress. These phase 1 results demonstrate that the dispersants, when tested alone, displayed roughly the same toxicities (slightly toxic to practically non-toxic). JD-2000 and COREXIT 9500 were generally less toxic to small fish and JD-2000 and SAF-RON Gold were less toxic to the mysid shrimp. Test results are posted at: http://www.epa.gov/bpspill/dispersants-testing.html#phase1. The results from the second phase of testing, released on August 2, 2010, demonstrate that for all eight dispersants in both test species, the dispersant alone was less toxic than the dispersant-oil mixture. The dispersant-oil mixtures can be generally categorized in the moderately toxic range. Oil alone was found to be more toxic to mysid shrimp than the eight dispersants when tested alone (and data for the silverside fish was inconclusive and are being re-tested with oil alone). Tests on oil alone had similar toxicity to mysid shrimp as the tests on dispersant-oil mixtures, with the exception of the mixture of Nokomis 3-AA and oil, which was found to be more toxic. http://www.epa.gov/bpspill/reports/phase2dispersant-toxtest.pdf

Results indicate that the eight dispersants, when tested alone and in combination with oil, are similar to one another. This confirms that the dispersant used in response to the Gulf oil spill, Corexit 9500A, is generally no more or less toxic than the other available and tested alternatives.

These externally peer reviewed results are publicly available on EPA's website at: http://www.epa.gov/bpspill/dispersants-testing.html.

These tests were designed to determine toxicity effects so that a relative comparison could be made. They were conducted over a range of concentrations, including those much greater than what aquatic life is expected to encounter in the Gulf. While these data are important, to date, for subsurface monitoring, we have not seen dissolved oxygen levels approach levels of concern to aquatic life and no excessive mortality in rotifers.

While more needs to be done, we see that the dispersants are working to help keep oil away from our precious shorelines and away from sensitive coastal ecosystems. We also know that the dispersants are less toxic than the oil released into the Gulf. To date, EPA monitoring has not found dispersant chemicals near coasts or wetlands. These results are posted at: http://www.epa.gov/bpspill/water.html. EPA will continue its environmental monitoring to identify any changes in conditions that could have an impact on human health or the environment.

Research and Development

This crisis has made it evident that additional research is needed. The Administration requested supplemental funds for dispersant research associated with the Deepwater Horizon oil spill which this Congress approved with the passage of the Supplemental Appropriations Act of 2010. EPA will engage academic institutions and other federal agencies, such as NOAA and DOI, who have the knowledge and expertise to supplement EPA's efforts. The additional $2.0

million requested by the President and approved by Congress will support research on the short and long-term environmental and human health effects associated with oil spill response technologies and dispersant use, and will further our research efforts to include innovative approaches to spill remediation. EPA, with our federal partners, will pursue an aggressive research agenda to address the mechanisms of environmental fate, effects, and transport of dispersants.

Summary and Conclusions

EPA will continue to provide full support to the USCG and the Unified Command and will continue to take a science based approach to dispersant use. We will continue monitoring, identifying, and responding to potential public health and environmental concerns, including waste management and beach cleanup. In coordination with our federal, state, and local partners, EPA is committed to protecting Gulf Coast communities from the adverse environmental effects of the Deepwater Horizon oil spill.

We will persist in asking the hard questions until we more fully understand the long-term effects of the Gulf oil spill and conduct the investigations required to enable the Gulf's recovery. We have taken nothing for granted. EPA has constantly questioned, verified, and validated decisions with monitoring, analysis, and use of the best available science and data.

EPA is fully committed to working with the people of the Gulf Coast, our federal partners, the scientific community and NGOs toward the recovery of the Gulf of Mexico and the restoration of its precious ecosystem. At this time, I welcome any questions you may have.

August 4, 2010
Hearing on the Use of Dispersants in the Deepwater Horizon Oil Spill
Before the Senate Environment and Public Works Committee
Questions for the Record

<u>**Senator Barbara Boxer:**</u>

1. Assistant Administrator Anastas, after BP's use of dispersants was limited by EPA and the Coast Guard on May 26; the company requested and received dozens of exemptions from these limitations. Could you please describe the role that EPA played in the process of approving those exemptions?

Response: Throughout the response, EPA worked closely with the Federal On-Scene Coordinator (FOSC) (U.S. Coast Guard (USCG)), as well as the Department of Commerce's National Oceanic and Atmospheric Administration (NOAA), and the Occupational Safety and Health Administration to aggressively monitor the deployment of dispersants. This involved regular consultation between EPA and the FOSC to ensure vigorous oversight of the proper thresholds for application of dispersants and to establish an aggressive dispersant monitoring plan by BP. USCG and EPA reviewed surface application of dispersants on a daily basis. Procedures were put in place to review requests for dispersant amounts the night before and verified by flyovers the next morning. Based on oil slick size parameters (e.g. oil thickness, area,) an agreement was reached on the amount of dispersant balanced with mechanical recovery, which was the preferred option when operationally feasible. Working together, these efforts accomplished the goal of the May 26, 2010 directive to reduce dispersant use by 75 percent from its peak levels.

2. Assistant Administrator Anastas, can you describe how EPA has tested the potential impact on organisms of using dispersants in a deep sea environment?

Response: EPA, in collaboration with NOAA, conducted monitoring while dispersants were being used subsurface. Monitoring efforts included tests for the presence of dispersed oil, measured levels of dissolved oxygen and droplet size distribution at all depths. In addition, acute screening toxicity tests (Rototox assays) were conducted at sea on a daily basis insofar as possible, while dispersants were being used subsea.

3. Assistant Administrator Anastas, could you please describe whether the temperature, water pressure and level of microbial activity at the Deepwater Horizon well could impact the dispersant and oil's rate of degradation and movement through the gulfs water column?

Response: Based on available data and modeling, EPA believes that the individual components of the two different dispersant formulations and oil degrades within days to weeks or months in shallow water and shoreline sediments and that, in general, it takes longer for oil to biodegrade than dispersants. In deep water, which is at higher pressures and lower temperatures, the chemicals and oil may persist longer due to these differences in environmental conditions. However, we also know that hydrocarbon-degrading microorganisms in deep waters, have evolved and adapted to cold temperatures and high hydrostatic pressures so it is not surprising that they are able to breakdown hydrocarbons as carbon and energy sources for growth. We do not know their capabilities in terms of biodegradation rates at this time.

4. Assistant Administrator Anastas, your testimony states that in studying the potential toxicity of dispersants, EPA conducted toxicity tests with "mysid shrimp and silverside fish ... " How representative are these animals of the most vulnerable species in the gulf to any potential toxic effects from dispersants, or oil mixed with dispersants, including coral? Also, did EPA test the shrimp or silverside fish during any particularly sensitive periods of their development?

Response: Mysid shrimp and silverside fish are considered to be sensitive species, and representative of the sensitivity of a broad range of aquatic invertebrates and fish living in the Gulf of Mexico. These species are standard test species and have been used for many years by EPA and others in standardized testing to assess the toxicity of chemicals, dispersants, and oil. EPA used the sensitive early life stages of these species for its toxicity assessments.

5. Assistant Administrator Anastas, do you plan to research how the use of dispersants to break down oil in a deepwater environment could potentially increase fish, wildlife or plants' uptake of these toxic substances?

Response: While research and chemical modeling information suggest the chemical components of the dispersant used in the Gulf are not bioaccumulated (i.e., absorbed faster than they are lost) by fish, wildlife, or plants, additional first-hand exposure research is needed, both on the dispersants alone, as well as on the oil itself and the dispersed oil to confirm this assertion. Research plans are currently in development. The Food and Drug Administration (FDA) and NOAA have developed a process for testing seafood for dispersant components that is currently being used to ensure that seafood is not contaminated with dispersants. EPA's bioaccumulation research will add to this knowledge by quantifying uptake and loss potential in various aquatic species.

6. Assistant Administrator Anastas, the National Academy of Sciences in 2005 said that "a particular concern [with the use of dispersants] stems from potential synergistic effects of exposure to dissolved components in combination with chemically dispersed oil droplets." They recommended that federal agencies and other stakeholders "develop and fund a series of focused toxicity studies to determine the mechanisms of both acute and sublethal toxicity to key organisms from exposure to dispersed oil." Has the EPA conducted or found that others have performed acute and sublethal toxicity tests involving dispersants and dispersant-oil mixtures on key organisms in the gulf?

Response: EPA conducted acute toxicity tests on eight dispersants listed on the National Contingency Plan (NCP) Product Schedule, the Louisiana Sweet Crude Oil, and dispersant-crude oil mixtures using two sensitive aquatic species indigenous to the Gulf: (1) the mysid shrimp, *Americamysis bahia*, an aquatic invertebrate, and (2) the inland silverside, *Menidia beryllina*, a small estuarine fish.

In addition, the Supplemental Appropriations Act of 2010 provides an investment of $2 million to study the potential human and environmental risks and impacts of the release of crude oil and the application of dispersants, surface washing agents, and other mitigation measures listed in the National Contingency Plan Product Schedule. Grants will be awarded to universities with expertise in oil spills and the use of dispersants, as well as expertise on the ecological systems in the Gulf region. This work will be coordinated, as appropriate, with the efforts of other federal agencies (National Science Foundation, National Institute of Environmental Health Sciences) and stakeholders.

Senator Thomas R. Carper:

1. How can we ensure proper study of these oil dispersants without unduly compromising the proprietary data of companies manufacturing the dispersants?

Response: EPA is complying with Trade Secret Act regulations for the protection of proprietary information and working with dispersant manufacturers on substantiation of confidential information.

Senator Bernard Sanders:

1. Although EPA is responsible for maintaining the National Contingency Plan Product Schedule, which lists chemical and biological products available for federal on-scene coordinators to use in spill response and cleanup efforts, inclusion of a dispersant on such list does not mean EPA has approved the dispersant as safe for organisms in the ecosystem. What short-term steps is EPA taking to determine, with more certainty, that in the event of a future oil spill, use of chemical dispersants included on the list will not harm humans or wildlife?

Response: In the short-term, EPA is collaborating with the National Response Team, Regional Response Teams (RRTs) and Area Contingency Planners (ACPs) to strengthen the criteria for dispersant use on oil spills and raise awareness of the need for careful consideration of the human and environmental tradeoffs. In the medium to longer term, EPA is developing a research strategy that will incorporate studies to address ecotoxicity in a more systematic manner. EPA will also be revising the NCP Subpart J to address lessons learned during the Deepwater Horizon Oil Spill Response.

Senator Kirsten E. Gillibrand:

Toxicity Testing of Corexit 9527

1. In the early days of the Deepwater Horizon response, BP was given permission to use two dispersants, Corexit 9500 and Corexit 9527. Corexit 9527 was used for about a month when more than 214,000 gallons had been applied at the surface. According to a May 26th letter to David Rainey, the Vice President of Gulf of Mexico Exploration for BP, EPA said that it would, " ... perform at least two types of assessments to evaluate Corexit 9500 and 9527 and other dispersants." However, EPA released the results from their Phase 1 & 2 toxicity testing

(June 30th and August 2 respectively), yet neither set of testing included an evaluation of the toxicity of Corexit 9527. Testing did include Corexit 9500 and other dispersants on the National Product Schedule. Further, EPA staff told Congressional staff during an August 2nd briefing that Nalco is discontinuing manufacture of Corexit 9527, and as a result, EPA could not get a quality sample of sufficient quantity to conduct toxicity testing. However, during the August 4th EPW Hearing on Dispersant Use, Dr. Anastas acknowledged the hazardous nature of an ingredient of Corexit 9527, 2-butoxyethanol.

Given the widespread use of Corexit 9527 in the Gulf; EPA's acknowledgement of a potentially harmful ingredient this formulation; and an official letter from EPA's Administrator stated they would test, my question is: what steps will EPA take to secure a stock of Corexit 9527 so that EPA can carry out the tests on Corexit 9527, as specified in the letter? Will those tests follow the same tests performed in Phase 1 & 2?

Response: The application of Corexit 9527 in the Gulf was stopped on May 22, 2010 with a total use of just under 215,000 gallons. The manufacturer did not manufacture this dispersant for use in the Gulf, and the tests previously anticipated were not conducted. However, if samples of Corexit 9527 can be procured, EPA will consider conducting tests to determine the longer-term effects of its use on the ecosystem. The main difference between Corexit 9527 and Corexit 9500 is the presence of 2-butoxyethanol in the former. EPA monitored for 2-butoxyethanol to determine potential exposures to the public and the environment. Further verification of the data collected indicated no detection of 2-butoxyethanol in any water samples collected in the Gulf. All of the sampling and monitoring data is posted on EPA's website (http://www.epa.gov/bpspill/index.html). As noted below, due to the ubiquity of 2-butoxyethanol, EPA cannot, with certainty, correlate the presence of 2-butoxyethanol in these samples with the application of Corexit 9527.

2. Water Samples and Biodegradation of Dispersants. According to data obtained from Unified Command, application of Corexit 9527, which contains a potentially hazardous ingredient, 2-butoxyethanol, was stopped on May 22nd. Though application was stopped, water sampling results posted on EPA's website and collected along the shoreline of the Gulf Coast indicate the presence of 2-butoxyethanol on July 8, 47 days after the last known application.

Can EPA, with certainty, correlate the presence of 2-butoxyethanol with the application of Corexit 9527? If so, does this mean that this dispersant is more persistent in the environment than initially expected? If not, what other sources may account for the presence of 2-butoxyethanol in the samples? What is EPA's plan to evaluate long-term effects on the environment and human health risks associated with the use of Corexit 9527 in the Gulf?

Response: 2-Butoxyethanol is a solvent in paints and surface coatings, as well as cleaning products and inks. It is frequently found in popular cleaning products and is the main ingredient of many home, commercial and industrial cleaning solutions. Consequently, EPA cannot, with certainty, correlate the presence of 2-butoxyethanol with the application of Corexit 9527. This solvent is only one ingredient in the dispersant formulation and not indicative of the environmental persistence of that dispersant. There are other dispersant components common to both Corexit 9500 and 9527 that will be considered for study in the longer term research strategy currently under development to address the potential long-term effects on human health and the environment.

3. Name Change - Chemical Change?

Throughout the response, Federal authorities, in reference to the two versions of Corexit have teetered between the former and current dispersant names. According to the Technical Product Bulletins on the National Contingency Plan Product Schedule the official names for Corexit 9500 and Corexit 9527 were renamed Corexit ®EC 9500A and Corexit ® EC9527A, in 1995.

With the name change, what chemical difference, if any, is there between the former and current reference names? Can the names be used interchangeably? Does EPA have data to support if the chemicals are the same, or different?

Response: According to our records, there is essentially no chemical difference between the two names used for Corexit 9527 and 9500. The manufacturer provided these names when their information was updated in 2009; all other chemical data remained the same. Furthermore, if a company changes any ingredient in its formulation, it must be recertified and relisted on the Product Schedule.

4. Future Research Dollars?

During the July 15th Senate Committee on Appropriations Legislative Hearing on Use of Dispersants in BP Oil Spill, at which Administrator Jackson testified, it was mentioned that the Administration is contemplating giving EPA and NOAA $2M to conduct research on dispersants.

If appropriated, how will EPA use its portion of the money?

Response: While EPA has done some research on dispersants, the response to the Deepwater Horizon oil spill demonstrates that gaps in the knowledge base regarding response technologies remain and that a larger commitment to researching the near- and long-term effects of spilled oil and dispersant use is needed. The Supplemental Appropriations Act of 2010 provides EPA an investment of $2 million to study the potential human and environmental risks and impacts of the release of crude oil and the application of dispersants, surface washing agents, and other mitigation measures listed in the National Contingency Plan Product Schedule.

EPA plans to issue grant awards to universities with expertise in oil spills and the use of dispersants, as well as expertise on the ecological systems in the Gulf region to study the potential human and environmental risks and impacts of the release of crude oil and the application of dispersants, surface washing agents, and other mitigation measures listed in the National Contingency Plan Product Schedule. Planned research will focus on the human health and environmental impacts of chemical dispersants and dispersed oil; the efficacy of dispersants and other oil spill mitigation measures; and the near and longer-term impacts of the Gulf Spill to human health and a broad range of aquatic and land species.

5. Policy Changes to the National Contingency Plan (NCP) Product Schedule. EPA staff reported, during an August 2nd Congressional staff briefing that EPA scientists were not able to secure Corexit 9527 from Nalco, the dispersant manufacturer, yet it remains on the NCP as an authorized dispersant. If Nalco is unable to provide a sample for testing, it is highly unlikely that they would be able or willing to produce adequate quantities to combat a future oil spill.

Given this decision by Nalco, what plans does EPA have to remove Corexit 9527 from the list of authorized dispersants?

Response: Because the use of Corexit EC9527A during the Gulf oil spill was stopped well before EPA embarked on its dispersant testing, and Nalco indicated that it did not plan to produce additional Corexit EC9527A for use on the Gulf oil spill, EPA did not seek to obtain a sample either from Nalco or from another potential source (e.g. any other company that may have it stored for use). At this time, EPA has no plans to remove Corexit EC9527A from the NCP Product Schedule, not only because Nalco may choose to resume production if another company wishes to purchase it for use (either domestically or internationally), but also because another company may have a previously purchased supply in storage that could be used on a future oil spill.

6. Besides Corexit 9527, 5 other dispersants found on the Product Schedule were not tested. What is the reason they were not tested? Are there plans for those products to be tested? Similar to Corexit 9527, was the EPA unable to get samples of the 5 remaining dispersants for testing?

Response: EPA chose eight dispersants from the dispersants listed on the National Contingency Plan Product Schedule based on three criteria: 1) the reported toxicity of the dispersant was lower than Corexit 9500 or of the dispersant when mixed with oil; 2) availability of sufficient quantities to respond to the Gulf spill; and 3) immediate availability of samples for testing. At this time, there are no plans to test the remaining products.

7. What are the requirements for manufacturers to maintain pre-authorized standing on the NCP? How often does EPA review the list of pre-authorized dispersants to ensure they still merit pre-authorized standing? Should it be necessary to delist a dispersant? What is the process for delisting products from the NCP?

Response: Under current regulations, a product remains on the Schedule until such time as the manufacturer makes any changes to the product composition, formula, handling procedures or application. At that time, the manufacturer must notify EPA and may be required to retest the product. EPA periodically reviews its files and the Schedule and contacts manufacturers to update any relevant information about the product. A product could be delisted if updated information about the product no longer meets the requirements for listing. A product could also be delisted if it is found the company misrepresents the product's approval, certification, authorization, licensing or promotion of the product.

Senator James M. Inhofe:

1. EPA approved Corexit and many other dispersants for use under the National Contingency Plan Product Schedule over 15 years ago in order to have dispersants readily available for use without bureaucratic delay. How, then, do you reconcile EPA's actions May 20th directive for BP to look for less toxic alternative dispersants, and then the May 26th directive ordering BP to scale back its overall use of dispersants?

Response: Once a product is listed on the Product Schedule, it is authorized for use by the Federal On-Scene Coordinator (FOSC) if the FOSC (the U.S. Coast Guard in the Gulf oil spill) determines that its use is appropriate for the conditions of a particular oil spill. While dispersant use on the surface was pre-approved for the Gulf, the Regional Response Team, comprised of representatives from other federal agencies and state representation, activated and confirmed the use for the surface and convened again in consultation with the National Response Team to assist the FOSC in making the determination for the subsurface application of dispersant. This was done as defined in the Area Contingency Plan related to "pre-approval" of dispersant use and modifications associated with that pre-approval.

EPA and the U.S. Coast Guard issued directives to BP due to the unprecedented quantity of dispersant being used and remaining uncertainties about the underwater use of dispersants.

2. Why did EPA not already have studies done on the toxicity levels of these preapproved dispersants, and what potential harmful effects could delaying their use or scaling it back have had on efforts to keep oil from coming ashore?

Response: EPA conducted its own toxicity tests to independently verify toxicity information previously submitted by product manufacturers and to compare across the available dispersant products the relative toxicity of the product and the product mixed specifically with Louisiana Sweet Crude oil. Dispersant use was scaled back to ensure that only the amount necessary was used on the spill in conjunction with comprehensive monitoring to minimize ecosystem impact. Since dispersant use is only one tool used by the Federal On-Scene Coordinator (FOSC) to respond to the spill (e.g. skimming, booming, burning, etc.) any potential negative impacts associated with the directed reduction in dispersant use would have been minimal.

3. During the hearing, the procedure for dispersants to get placed on EPA's preapproved list was a lengthy topic of conversation. It was suggested that the dispersant manufacturers themselves test the safety and effectiveness of dispersants and EPA's approval process is somewhat of a meaningless rubber stamp. As I understand it, this is an incomplete characterization, as the testing is done through third-party, EPA approved labs. Can you clarify who is doing the testing and where, prior to EPA pre-approval of dispersants?

Response: Manufacturers are required to have their products tested according to EPA protocols and procedures at certified laboratories. EPA provides a list of approved laboratories to manufacturers. Test data submitted by a manufacturer are carefully reviewed to make sure the tests are conducted properly and quality assured.

4. Some press reports indicate that pressure from environmental groups, not the EPA's own scientific concerns, led EPA and the Coast Guard to issue May directives to scale back the use of dispersants. What was your interaction during that time with those groups with regard to dispersant use? What role, if any, did those groups play in your decision making?

Response: During the response, EPA established and maintained open dialogue with a wide variety of stakeholders including environmental groups, the public, industry and scientific and academic communities. EPA's decisions are based on the best available science, and as the EPA Science Advisor, it is my role to ensure that sound science is incorporated into EPA's decision-making processes. I personally visited the Gulf region and met with scientists to better understand their research and results related to assessing the environmental impacts of the oil spill and the use of dispersants and to hear their concerns. The results of these discussions were incorporated into my subsequent discussions with and recommendations to our Administrator.

5. There have been recent claims that dispersants mixed with oil are creating some sort of "toxic stew of chemicals" that in essence could be more harmful than the oil itself. Would you say that EPA's recent research disproves those claims?

Response: EPA's testing showed that for all eight dispersants tested in both test species, the dispersants alone were less toxic than the dispersant-oil mixtures. Oil alone was found to be more toxic to mysid shrimp than the eight dispersants when tested alone. Oil alone had similar toxicity to mysid shrimp as the dispersant-oil mixtures.

6. In the July 15, 2010 Commerce, Justice, Science, and Related Agencies Subcommittee Hearing on the use of dispersants in the spill, nearly three months after the BP spill began, EPA Administrator Jackson stated that she was unclear as to her authority to regulate the use of dispersants during the Gulf spill. Do the agency and the administrator now finally have a clear understanding of what power and authority they have? Can you describe that authority for the record?

Response: Regulatory authority is granted to EPA by the National Contingency Plan and the Clean Water Act as amended by the Oil Pollution Act of 1990.

7. Judging from the current reports that dispersants have been successful in the Gulf with no discernable concomitant environmental damage. Would you support a moratorium on the use of dispersants for further study?

Response: No. Dispersants can be a valuable tool in certain circumstances and should be available to a Federal On-Scene Coordinator (FOSC) along with other mechanical and/or chemical countermeasures to address an oil spill. More work is needed to ensure that we better understand any potential long-term impacts on the environment associated with surface and subsea use of dispersants but this need does not justify imposing a moratorium on the appropriate use of dispersants when necessary. In addition, work is needed to develop and promote the development of green dispersants and more sustainable solutions.

8. There was a good deal of discussion during the hearing about Corexit 9527 and its potential effects on workers and the environment. As I understand it, only Corexit 9500 has been produced for use in response to the BP spill and any use of the older compound was done out of necessity from existing stockpile. Is this correct?

Response: Yes, to the best of my knowledge.

9. From your vantage point, is it fair to say that federal agencies took into account potential damages from dispersants and came to the conclusion that any negative effects from their use would more than likely outweigh those of oil spewing into the Gulf?

Response: Yes. Use of dispersant involves environmental trade-offs between allowing oil to reach sensitive environments near shorelines and aquatic waterfowl species on the open sea surface vs. dispersed oil transition into the water column. The Regional Response Team and Unified Command worked together to try to ensure that no more dispersant than was necessary was used in combination with mechanical means to minimize the impacts on shorelines and to the Gulf ecosystem.

10. Can you describe how, in the Unified Command, EPA was involved in the decisions on the use of dispersants, and to your knowledge, were there any specific incidences where EPA recommended to the Coast Guard or Unified Command that dispersants not be used that were ignored?

Response: EPA and the Unified Command held daily conference calls and meetings with regard to dispersant use and coordinated on all decisions.

11. Could you please provide us with the names of the offices within EPA as well as the EPA Regions that have full access to samples, ingredients and mixtures of dispersants, particularly Corexit 9500?

Response: The EPA Office of Emergency Management within the Office of Solid Waste and Emergency Response is the EPA office that retains (and protects) all Confidential Business Information (CBI) records for dispersants on the National Contingency Plan Product Schedule. Employees who are provided CBI information must be cleared and demonstrate a need to know. EPA's Office of Research and Development laboratories acquired samples from the manufacturers through the Office of Emergency Management and had access to dispersant samples and company provided or publically available lists of constituents.

Senator WHITEHOUSE. Thank you, Doctor.

We will hear now from Mr. David Westerholm, who is the Director of the Office of Response and Restoration at the National Oceanic and Atmospheric Administration. After a brief hiatus in the private sector, he came to that position from a 27-year career in the Coast Guard. We welcome his testimony.

Mr. Westerholm.

STATEMENT OF DAVID WESTERHOLM, DIRECTOR, OFFICE OF RESPONSE AND RESTORATION, NATIONAL OCEAN SERVICE, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, U.S. DEPARTMENT OF COMMERCE

Mr. WESTERHOLM. Good morning, Chairman Whitehouse, Chairwoman Boxer, and members of the Committee and Subcommittee. Thank you for the opportunity to testify on the National Oceanic and Atmospheric Administration's role in the Deepwater Horizon BP oil spill response and the use of dispersants.

I appreciate the opportunity to discuss the critical roles NOAA serves during oil spills and the importance of our contributions to protect and restore natural resources, communities, and economies affected by this tragic event.

The Deepwater Horizon spill is a stark reminder that large oil spills still occur and that we must rebuild and maintain our response capacity. When an oil spill does occur, there are no good outcomes. Once oil has spilled, responders and a variety of spill countermeasures are used to reduce the adverse effects of the spilled oil on the environment. The goal of the Unified Command is to minimize that environmental damage and speed recovery of injured resources.

Under the Clean Water Act the EPA is required to prepare and maintain a schedule of dispersants and other mitigating devices and substances that may be used to carry out the National Contingency Plan. This plan requires a Regional Response Team, in which NOAA and the States participate, to plan the use for or non-use of dispersants in advance of spills to ensure that the trade-off decisions between water column and surface and shoreline impacts are deliberated.

Additionally, NOAA's scientific support team is designated as a special team under this plan and provides a broad array of scientific services to the response, including recommendations to the Federal on-scene coordinator on the appropriate use of dispersants. NOAA is also a member of the Special Monitoring of Applied Response Technology programs, known as SMART, which is an interagency cooperatively designed program to monitor the efficacy of dispersants in situ burning operations.

For the Deepwater Horizon spill the Unified Command's response posture has been to fight the spill offshore and reduce the amount of oil that comes ashore, using a variety of countermeasures, including subsurface recovery, booming, skimming, burning, and dispersants. No single response is 100 percent effective, and each has its own window of opportunity, defined by the state of oil and weather and sea state, thereby establishing a need to consider the use of all available methods. Chemical dispersants can be an effective tool in the response strategy, but like all methods, involve trade-offs in terms of effectiveness and potential for collateral impacts.

Consideration of what we have learned from both research and real world experience has factored into the decisionmaking on the use of dispersants for the spill. Research on the effectiveness and effects of dispersants and dispersed oil has been underway for more than three decades, but vital gaps still exist.

For example, while numerous studies have been conducted on the fate and transport of oil dispersed on the surface, areas such as the rate of biodegradation and dispersed oil modeling in deeper waters are much less understood. One area of focus has been on determining toxicity and long-term effects of dispersants and dispersed oil on sensitive marine life. We also know that effectively dispersed oil will decline more rapidly in concentration than untreated surface or shoreline oil due to ocean mixing and biodegradation.

The effects of the dispersed oil on marine life depend on concentration and duration of exposure of organisms to the dispersed oil. At the sea surface, early life stages of fish and shellfish are much more sensitive than juveniles or adults to dispersants and dispersed oil. This increased sensitivity, coupled with the fact that these organisms reside just below the surface of the ocean where the concentrations of dispersed oil are initially the greatest, means that these organisms are most likely to be impacted.

There are no data on the toxicity of dispersed oil to deep sea biota any life stage. So we have to make inferences based on the existing body of research. However, at both the surface and the subsurface, modeling and monitoring are confirming that dispersed oil concentrations decline rapidly with distance from the wellhead as the oil mixes with seawater and moves with the currents away from the treatment areas.

NOAA has been conducting chemical analysis of seafood collected in the aftermath of the Deepwater Horizon incident. Seafood samples consisting of fin fish, shrimp, and oysters are analyzed for polycyclic aromatic hydrocarbons, or PAHs, to determine the uptake of these PAHs present in oil by marine species. To date, none of the seafood samples analyzed have PAH concentrations that exceed NOAA and FDA guidelines, ensuring seafood reaching the marketplace is safe to eat.

To conclude, as the response to this oil spill continues, the Unified Command will continually reevaluate our response strategies, action, and planning. NOAA will continue to provide scientific support to Unified Command and work with our co-trustees on the natural resource damage assessment.

I would like to assure you that we will not relent in our efforts to protect the livelihoods of Gulf Coast residents and mitigate the environmental impacts of this spill. Thank you for allowing me to testify on NOAA's response. I am happy to answer any questions that you may have.

[The prepared statement of Mr. Westerholm follows:]

WRITTEN STATEMENT OF
DAVID WESTERHOLM
DIRECTOR, OFFICE OF RESPONSE AND RESTORATION
NATIONAL OCEAN SERVICE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

HEARING ON
THE USE OF DISPERSANT FOR THE DEEPWATER HORIZON BP OIL SPILL

BEFORE THE
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE

August 4, 2010

Thank you, Chairman Boxer and Members of the Committee, for the opportunity to testify on the Department of Commerce's National Oceanic and Atmospheric Administration's (NOAA) role in the Deepwater Horizon BP oil spill response and the use of dispersants. My name is David Westerholm and I am the Director of NOAA's Office of Response and Restoration. I appreciate the opportunity to discuss the critical roles NOAA serves during oil spills and the importance of our contributions to protect and restore the natural resources, communities, and economies affected by this tragic event.

NOAA's mission is to understand and predict changes in the Earth's environment. NOAA also conserves and manages coastal and marine resources to meet our Nation's economic, social, and environmental needs. As a natural resource trustee, NOAA is one of the federal agencies responsible for protecting, assessing, and restoring the public's coastal natural resources when they are harmed by oil spills. As such, the entire agency is deeply concerned about the immediate and long-term environmental, economic, and social impacts to the Gulf Coast and the Nation from this spill. NOAA is fully mobilized and working tirelessly to reduce impacts on the Gulf Coast and will continue to do so until the spill is controlled, oil is cleaned up, natural resource injuries are assessed, and restoration is complete.

My testimony today will discuss NOAA's role in the Deepwater Horizon response and natural resource damage assessment process associated with the Deepwater Horizon oil spill, for which BP is a responsible party; NOAA's role in use of dispersants as a countermeasure to mitigate the impacts of the spill; and opportunities to strengthen the federal response to future events through research and development.

NOAA'S ROLES DURING OIL SPILLS
NOAA has three critical roles mandated by the Oil Pollution Act of 1990 and the National Contingency Plan (NCP):

1. During the emergency response, NOAA conducts research and monitoring and communicates scientific information to the Federal On-Scene Coordinator (FOSC). The

Scientific Support Team is designated as a special team in the NCP and provides a broad array of scientific services to aid the response.

2. As a natural resource trustee, NOAA conducts a Natural Resource Damage Assessment (NRDA) jointly with co-trustees to assess and restore natural resources injured by the oil spill. NRDA also assesses the lost uses of those resources, such as recreational fishing, and swimming, with the goal of implementing restoration projects to address these losses.
3. Finally, NOAA represents the Department of Commerce in spill response preparedness and decision-making activities through the National Response Team and the Regional Response Teams.

Response

The U.S. Coast Guard (USCG) is the FOSC and has the primary responsibility for managing coastal oil spill response and clean-up activities in the coastal zone. During an oil spill, NOAA's Scientific Support Coordinators deliver technical and scientific support to the USCG. NOAA's Scientific Support Coordinators are located around the country in USCG Districts, ready to respond around the clock to any emergencies involving the release of oil or hazardous substances into the oceans or atmosphere. Currently, NOAA has deployed all of its Scientific Support Coordinators from throughout the country to work on the Deepwater Horizon BP oil spill.

With over thirty years of experience and using state-of-the-art technology, NOAA continues to serve the Nation by providing its expertise and a suite of products and services critical for making science-based decisions. Examples include trajectory forecasts on the movement and behavior of spilled oil, overflight observations, spot weather forecasts, emergency coastal survey and charting capabilities, aerial and satellite imagery, and real-time coastal ocean observation data. Federal, state, and local entities look to NOAA for assistance, experience, local perspective, and scientific knowledge. NOAA's Office of Response and Restoration was called upon for scientific support 200 times in 2009.

Natural Resource Damage Assessment

Stewardship of the Nation's natural resources is shared among several federal agencies, states, and tribal trustees. NOAA, acting on behalf of the Secretary of Commerce, is the lead federal trustee for many of the Nation's coastal and marine resources, and is authorized by the Oil Pollution Act of 1990 (OPA) to recover damages on behalf of the public for injuries to trust resources resulting from an oil spill. Regulations promulgated by NOAA under the Oil Pollution Act encourage compensation in the form of restoration of the injured resources, and appropriate compensation is determined through the NRDA process. Since the enactment of OPA, NOAA, together with other federal, state, and tribal co-trustees, has recovered approximately $500 million for restoration of natural resources injured by releases of oil or hazardous substances, as well as injuries to national marine sanctuary resources, including vessel groundings.

National and Regional Response Teams

The National Oil and Hazardous Substances Pollution Contingency Plan, more commonly called the NCP, is the federal government's blueprint for responding to both oil spills and hazardous substance releases. The NCP's purpose is to develop a national response capability and promote overall coordination among the hierarchy of responders and contingency plans. NOAA represents the Department of Commerce on the National Response Team and Regional Response

Teams which develops policies on dispersant use, best clean-up practices and communications, and to ensure access to science-related resources, data, and expertise during responses to oil spills.

NOAA'S ROLE IN THE DEEPWATER HORIZON RESPONSE

NOAA's scientific experts have been assisting with the response from the first day of the Deepwater Horizon BP oil spill, both on-scene and through our headquarters and regional offices. NOAA's support includes daily trajectories of the spilled oil, weather data to support short and long range forecasts, and hourly localized 'spot' forecasts to determine the use of weather dependent mitigation techniques such as oil burns and chemical dispersant applications. NOAA uses satellite imagery and real-time observational data on the tides and currents to predict and verify oil spill location and movement. To ensure the safety of fishermen and consumer seafood safety, NOAA scientists are in the spill area taking water and seafood samples, and NOAA has put fisheries closures in place to maintain consumer confidence in the safety of consuming seafood from the Gulf of Mexico region. In addition, NOAA experts are providing expertise and assistance regarding sea turtles, marine mammals, and other protected resources such as corals.

At the onset of this oil spill, NOAA quickly mobilized staff from its Damage Assessment Remediation and Restoration Program to begin coordinating with federal and state co-trustees and the responsible parties to collect a variety of data that are critical to help inform the NRDA. NOAA is coordinating the NRDA effort with the Department of the Interior (another federal co-trustee), as well as co-trustees in five states and representatives for at least one responsible party, BP. NOAA and the co-trustees are in the initial phase of this process and are currently gathering data on resources such as fish, shellfish, birds, and turtles, and mammals; their supporting habitats such as wetlands, beaches, and corals; and human uses of affected resources, such as fishing and recreational uses across the Gulf of Mexico. The trustees will then quantify the total losses and develop restoration projects that compensate the public for their losses.

THE USE OF DISPERSANTS

The Deepwater Horizon BP oil spill is a stark reminder that large oil spills still occur, and that we must rebuild and maintain our response capacity. When an oil spill occurs, there are no good outcomes. Once oil has spilled, responders use a variety of oil spill countermeasures to reduce the adverse effects of spilled oil on the environment. The goal of the Unified Command is to minimize the environmental damage and speed recovery of injured resources. The overall response strategy to accomplish this goal is to maximize recovery and removal of the oil being released while minimizing any collateral damage that might be caused by the response itself. This philosophy involves making difficult decisions, often seeking the best way forward among imperfect options.

Under section 311 of the Clean Water Act, the U.S. Environmental Protection Agency (EPA) is required to prepare and maintain a schedule of dispersants and other mitigating devices and substances that may be used in carrying out the NCP. The NCP requires Regional Response Teams (RRT), in which NOAA participates, and Area Committees to plan in the advance of spills for the use or non-use of dispersants, to ensure that the tradeoff decisions between water column and surface/shoreline impacts are deliberated. As the FOSC for this spill response, the

U.S. Coast Guard is responsible for approving the use of the specific dispersant used from the NCP Product Schedule. Because of the unprecedented nature of the dispersant operations, the monitoring and constraints on application volumes and methodologies are being closely managed. In particular, EPA has specified effectiveness and impact monitoring plans, application parameters, and action thresholds. Any changes to specific Deepwater Horizon dispersant plans require the concurrence of EPA and other RRT decision agencies, including NOAA, under the NCP.

NOAA's Scientific Support Team is designated as a special team in the NCP and provides a broad array of scientific services to the response, including recommendations to the FOSC on the appropriate use of dispersants. NOAA is also a member of the Special Monitoring of Applied Response Technologies (SMART) program, an interagency, cooperatively designed program to monitor the efficacy of dispersant and *in situ* burning operations. SMART relies on small, highly mobile teams that collect real-time data using portable, rugged, and easy-to-use instruments during dispersant and *in situ* burning operations. Data are channeled to the Unified Command to help address critical questions. NOAA also uses SMART data to inform 24, 48 and 72 hour oil fate and trajectory models as dispersants can augment the behavior of the spilled oil.

The Gulf of Mexico shorelines, and Louisiana's in particular, possess extensive marsh habitats that are critical for wildlife and fisheries and shoreline protection. NOAA's environmental sensitivity index maps rank shoreline vulnerability to oil spills, and marshes are considered the most sensitive. Louisiana's marshes are already in a weakened condition and large areas are lost every year. These marshes and biota are extremely sensitive to oil, very difficult to clean up, and highly vulnerable to collateral impacts from response efforts.

For the Deepwater Horizon BP oil spill, the Unified Command's response posture has been to fight the spill offshore and reduce the amount of oil that comes ashore, using a variety of countermeasures including subsurface recovery, booming, skimming, burning, and dispersants. No single response method is 100 percent effective, and each has its own "window of opportunity" defined by the density and state of the oil and weather and sea state conditions, thereby establishing a need to consider the use of all available methods. Given the size and complexity of the Deepwater Horizon BP oil spill, no combination of response actions can fully contain the oil or completely mitigate the impacts until the well is brought under control. But given the enormous volume and geographic extent of the spill, the response to date has been successful in limiting shoreline impacts.

Chemical dispersants can be an effective tool in the response strategy, but like all methods, involve trade-offs in terms of effectiveness and potential for collateral impacts. Although mechanical recovery using skimmers is the preferred method of offshore oil spill response because it removes the oil from the environment, it is generally ineffective unless seas are fairly calm. The use of dispersants to mitigate offshore oil spills is a proven and accepted technology to reduce the impacts to shorelines and, under certain conditions, can be more effective than mechanical response. This is largely due to the fact that spray aircraft can encounter much more of the floating oil, and more quickly, than can skimmers Dispersants have been used effectively to respond to spills both in the U.S. and internationally. In the U.S., notably in the Gulf of Mexico, dispersants have been used during the past 15 years against much smaller spills off

Louisiana and Texas. The largest use of dispersants in North America (2.7 million gallons) was in the Gulf of Mexico during the 1979-80 Ixtoc I blowout in Campeche Bay, Mexico. The Deepwater Horizon BP oil spill response used about 1.8 million gallons of dispersant.

The NCP establishes a framework for the use of dispersants in an oil spill response. The NCP states that RRT and Area Committees will address, as part of their planning activities, the desirability of using dispersants and oil spill control agents listed on the NCP's National Product Schedule. The NCP goes on to state that Area Contingency Plans (ACP) will include applicable pre-authorization plans and address the specific contexts in which such products should and should not be used. If the RRT representatives for EPA, the Department of Commerce, and Department of the Interior natural resource trustees, and the states with jurisdiction over the regional waters for which the preauthorization plan applies, approve in advance the use of certain dispersant products under specified circumstances as described in the preauthorization plan, the FOSC may authorize the use of the products without obtaining additional concurrences. In Region VI, which includes the Gulf of Mexico, dispersant use is pre-authorized in offshore water, beyond the 3-mile limit. The preauthorization of alternative countermeasures in the response plans allows for quick implementation of the pre-approved countermeasures during a response, when timely action is critical to mitigate environmental impacts.

For all dispersant operations, the FOSC must activate the SMART monitoring team to monitor the effectiveness of the dispersant. Dispersant use for the Deepwater Horizon BP oil spill was performed in accordance with ACP guidelines and with RRT approval. In consideration of the size and duration of the oil spill, the amounts of dispersant being used, and the uncommon sea bed injection method of application, a directive was approved by EPA and state representatives for the Region 6 Regional Response Team to put specific restrictions and monitoring requirements in place concerning dispersant use for the Deepwater Horizon BP oil spill as a condition of FOSC authorization for use. NOAA's Scientific Support Coordinators, supported by NOAA's team of scientists and in consultation with trustees, is advising the FOSC on when and where dispersants should be used to determine the most effective and appropriate use of dispersants.

Dispersants are chemicals that may be applied directly to the spilled oil in order to remove it from the water surface by dispersing it into the upper layer of the water column. Dispersants are commonly applied through specialized equipment mounted on an airplane, helicopter or ship. The dispersant must be applied as a mist of fine droplets and under a specific range of wind and sea state conditions. Once applied at the surface, dispersants help break up the oil into tiny droplets (20-100 microns across; a micron is the size of the cross section of a hair) which mix into the upper layer of the ocean. Because of the high encounter rate of aircraft, they allow for the rapid treatment of large areas. Dispersed oil does not sink; rather it forms a "plume" or "cloud" of oil droplets just below the water surface. The dispersed oil mixes vertically and horizontally into the water column and is diluted. Once formed, bacteria and other microscopic organisms then act to degrade the oil within the droplets more quickly than if the oil had not been chemically dispersed. It should be noted that oil spilled from the Deepwater Horizon BP oil spill is also naturally dispersing into the water column due to the physical agitation of the wind, waves, and vessel operations.

During the first few months of the Deepwater Horizon BP oil spill, subsurface dispersants were applied directly at the wellhead where oil was being released through the use of Remotely Operated Vehicles (ROV). The decision to use subsurface applications was made by the FOSC with concurrence by RRT Region VI after several test applications to determine the efficacy, and development and implementation of a monitoring protocol. Monitored levels of dissolved oxygen levels within the dispersed oil plume and rotifer toxicity test results were reviewed daily to determine whether changes in the sea bed injection protocol should be considered. While there has been virtually no dispersant use since the well was capped on July 15, BP is continuing its environmental monitoring, under an EPA directive.

Spill response often involves a series of environmental trade-offs. The overall goal is to use the response tools and techniques that will minimize the overall environmental damage from the oil. The use of dispersants is an environmental trade-off between impacts within the water column, on the sea surface (birds, mammals, and turtles in slicks) and on the shore. Dispersants do not remove the oil from the environment, but it does speed up biodegradation of the oil. When a decision is made to use dispersants, the decision maker is reducing the amount of oil on the surface where it may affect birds, mammals and turtles, when they are at or near the surface, and ultimately that oil that may come ashore, in exchange for increasing the amount of oil in the upper layer of the water column 40 miles off shore. While the effects of dispersants on some water column biota have been studied, the effects of dispersants and dispersed oil below the surface on wildlife such as diving birds, marine mammals, and sea turtles are unknown. Under ideal conditions, each gallon of dispersant applied offshore prevents about 20 gallons of oil from coming onto the beaches and into the marshes of the Gulf Coast.

The Gulf coast is home to coastal wetlands and marshes that are biologically productive and ecologically important to nesting waterfowl, sea turtles, fisheries, and essential fish habitat. The Gulf of Mexico region's ecological communities are essential to sustaining local economies, recreational experiences, and overall quality of life. The extensive marshes themselves provide coastal communities with protection from severe storms, such as Hurricane Katrina. These habitats are highly sensitive to oiling. Once oil does impact marshes, there are limited cleanup options, and potential for significant long-term impacts. As oil has moved ashore from the Louisiana coast to the Florida panhandle from the Deepwater Horizon BP oil spill, we have seen firsthand the impacts this oil has on these habitats, and to birds, turtles and other wildlife. Although it may not be readily apparent, use of dispersants offshore and in deep water, is reducing the amount of oil reaching the shoreline, reducing the amount of shoreline cleanup that will be required, and helping to reduce recovery time of injured nearshore resources. Without the use of dispersants, the shoreline impacts along the Gulf coast from the Deepwater Horizon BP oil spill would be greater.

RESEARCH ON THE EFFECTIVENESS AND EFFECTS OF DISPERSANTS AND DISPERSED OIL

Research on the effectiveness and effects of dispersants and dispersed oil has been underway for more than three decades. Much of what we have learned from both research and real world experience is presented in detail in the 2005 National Research Council (NRC) report "Oil Spill Dispersants: Efficacy and Effects." The NRC identified gaps in our knowledge. Gaps in oil spill knowledge were narrowed by research and development activities carried out through projects conducted by the Coastal Response Research Center (CRRC), and state and federal agencies, and academia. The CRRC was a successful joint partnership established in 2004 between the University of New Hampshire and NOAA's Office of Response and Restoration.

One area of focus has been on determining the toxicity and effects of dispersants and dispersed oil on sensitive marine life. It is now quite clear that effectively-dispersed oil declines rapidly in concentration due to ocean mixing, degrades faster than untreated surface or shoreline oil, and that the toxicity of dispersants is considerably less than the toxicity of the oil that is dispersed. The acute (four day) toxicity of dispersants and dispersed oil for the most sensitive species and life stages of fish and crustaceans occurs at concentrations in the low part per million (ppm) range (data compiled from NAS 2005: Oil Spill Dispersants: Efficacy and Effects). Despite this general statement, reports exist of more sensitive life stages and species. For example, effects on fertilization and metamorphosis of coral larvae are reported at sub-part per million concentrations (e.g., Negri and Heyward (2000), Marine Pollution Bulletin 41(7-12): 420-427). Very little is known about the species found in the deep ocean near the Deepwater Horizon BP oil spill release site or the susceptibility of these species to dispersed oil toxicity at cold temperatures and high pressures.

On June 30, 2010, the EPA released its initial test results on the toxicities of eight different dispersants on silverside fish and small crustacean species in an early life stage. The primary purpose of these studies was to determine the toxicity differences among different dispersant products. Corexit 9500, the main product used in the Deepwater Horizon BP oil spill response, was found to be "slightly toxic" for one test species and "practically non-toxic" for the other. LC50 concentrations, the concentration at which half the test organisms died, were 42ppm and 130ppm respectively.

The effects of the dispersed oil on marine life depend on concentration and duration of exposure of organisms to the dispersed oil. At the sea surface, early life stages (eggs and larvae) of fish and shellfish are much more sensitive than juveniles or adults to dispersants and dispersed oil. This increased sensitivity coupled with the fact that these organisms reside just below the surface of the ocean (as do plankton, zooplankton) where concentrations of the dispersed oil were initially highest, may have had a greater impact on these organisms. There are no data on the toxicity of dispersed oil to deep-sea biota at any life stage, so we have to extrapolate based on existing knowledge of other aquatic species. However, in both regions (surface and deepwater), some modeling and monitoring is showing that dispersed oil concentrations may decline rapidly with distance from the well head as the "clouds" or "plumes" mix with sea water and move with the currents away from the treatment areas.

NOAA's National Marine Fisheries Service laboratories in Seattle, Washington have been conducting chemical analysis of seafood collected in the aftermath of the Deepwater Horizon BP oil spill. Seafood samples, consisting of finfish, shrimp, and oysters are analyzed to measure uptake of polycyclic aromatic hydrocarbons (PAH) present in oil by marine species. To date, none of the seafood samples analyzed have PAH concentrations that exceed EPA and Food and Drug Administration guidelines, ensuring seafood reaching marketplace is safe to eat. NOAA also has expertise in determining the effects from exposure to oil on fish. The research shows that early life stages of fish are sensitive to the predominant PAHs in oil.

While numerous studies have been conducted on the fate and transport of oil dispersed on the surface, the fate and transport of oil dispersed at depth is less understood. While the application of dispersants into a subsurface plume had never been studied prior to the Deepwater Horizon BP oil spill, we expect the result to be similar to that of surface dispersant application, and thus result in even smaller droplets of oil in the plume. These very small droplets (100 microns) will rise extremely slowly while being mixed by background turbulence, so that they stay at depth, moving with the currents, until biodegraded, consumed by naturally occurring micro-organisms, or adhere to sinking sediment. An open scientific question for DWH is the effects of physical processes versus chemical dispersant in creating small droplets of oil seen around the wellhead.

Another major activity involving marine resource trustees has been a series of nearly 20 Consensus Ecological Risk Assessment (C-ERA) Workshops which were held all around the U.S. and adjacent international coastlines. These workshops, many lasting one week or more and sponsored by the U.S. Coast Guard, EPA and Department of the Interior, focused the attention of trustees of alternative response scenarios of large spills, including no response, on-water mechanical removal, *in situ* burning, dispersant use and shoreline clean up. Trustees evaluated the impacts and benefits of each realistic response option to their trust resources (marshes, shorelines, mammals, birds, fish, etc.) and then had to work on reaching consensus regarding the least damaging mix of response options for their specific area. The results of these workshops have provided valuable information for revising response plans in a number of states and countries.

ACTIVITIES TO ASSESS PRESENCE OF SUBSURFACE OIL FROM DEEPWATER HORIZON SPILL

Since the beginning of May, NOAA has been conducting and coordinating sampling of the sub-surface region around the Deepwater Horizon well-head and beyond to characterize the presence of subsurface oil. The sub-surface search involves the use of sonar, UV instruments called fluorometers, which can detect the presence of oil and other biological compounds, and collection of water samples from discrete depths using a series of bottles that can be closed around a discrete water sample.

NOAA, federal partners, academics, and others in the research community have mobilized to research and quantify the location and concentration of subsurface oil from the spill. NOAA Ships *Gordon Gunter, Thomas Jefferson, Henry Bigelow, Nancy Foster,* and *Delaware II* have conducted missions to collect water samples from areas near the wellhead as well as further from the wellhead and in the coastal zone. Water samples from many of these missions are still being analyzed and additional missions are in progress or being planned to continue the comprehensive effort to define the presence of oil below the surface and understand its impacts.

Water samples taken by researchers on the *R/V Pelican, R/V Walton,* and the *R/V Weatherbird II* have also been analyzed for the presence of subsurface oil. These samples from the R/V *Weatherbird* II confirmed low concentrations of surface oil from the Deepwater Horizon BP oil spill 40 nautical miles northeast of the wellhead. Additionally, hydrocarbons were found in samples 45 nautical miles northeast of the wellhead-at the surface, at 50 meters, and at 400 meters-however, the concentrations were too low to confirm the source, and work continues on these samples.

In accordance with FOSC and EPA requirements for the use of subsurface dispersants, BP contracted ships, *R/V Brooks McCall* and the *R/V Ocean Veritas*, have been collecting water samples in the area close to the wellhead since May 8, 2010 and continue to do so. Samples collected to date confirm the existence of a cloud of diffuse oil at depths of 3,300 to 4,600 feet near the wellhead. Initial total petroleum hydrocarbon (TPH) concentrations in the cloud at these depths, during active flow, ranged from 1000-8000 parts per billion (ppb). Post-flow concentrations have declined to less than 100 ppb and are being measured as far as 50 kilometers from the source. Analysis shows the concentration of this cloud generally decreases with distance from the wellhead. Decreased droplet size is consistent with chemically-dispersed oil. Dissolved oxygen levels in the water column are largely what are expected compared with historical data.

The Unified Command has established an inter-agency Joint Analysis Group (JAG) to aggregate and analyze all the relevant data from the many subsurface oil missions in order to have a comprehensive picture of the situation. This group is made up of federal scientists from NOAA, EPA and the Office of Science and Technology Policy. The JAG has issued two major reports on subsurface oil and continues to synthesize data from field sampling and modeling.

CONCLUSION

As the response to this oil spill continues, the Unified Command will continually reevaluate our response strategies, actions, and planning. NOAA will continue to provide scientific support to the Unified Command and continue our coordination with our federal and state co-trustees on the NRDA. I would like to assure you that we will not relent in our efforts to protect the livelihoods of Gulf Coast residents and mitigate the environmental impacts of this spill. In conjunction with the other federal agencies, we will continue to monitor the use of dispersants and as new information is generated we will appropriately advise the Unified Command. Thank you for allowing me to testify on NOAA's response efforts. I am happy to answer any questions you may have.

Environment and Public Works Committee Hearing
August 4, 2010
Follow-Up Questions for Written Submission
Questions for David Westerholm

Senator Barbara Boxer

QUESTION #1: Director Westerholm, your testimony states that NOAA has a Scientific Team that "provides a broad array of scientific services to the response, including recommendations to the [Federal On-Scene Coordinator] on the appropriate use of dispersants" in gulf oil spill response activities. Could you please describe the types of recommendations that NOAA has made on the use of dispersants in the gulf, and any tests that NOAA relied on for those recommendations?

ANSWER:
Dispersant use was pre-approved some years ago for offshore use by the Regional Response Teams. That pre-approval was based on years of discussion and tradeoff evaluations. In this spill, NOAA recommended that protection of shorelines, marshes, and nearshore waters be prioritized based on the ecological and economic sensitivity of and potential for persistence of oil in these areas. It was determined by members of the Regional Response Team, including NOAA and EPA, that the potential environmental cost of using dispersants offshore could be outweighed by the harm that would be caused by heavy shoreline oiling of undispersed oil. This tradeoff was based on over 20 years of scientific study of dispersant and oil impacts. An expert panel of scientists was convened at Louisiana State University by the University of New Hampshire's Coastal Response Research Center (CRRC) and concurred with this recommendation. Monitoring of both surface and subsurface applications was conducted to measure concentrations of oil, toxicity, and dissolved oxygen. The monitoring test results supported the application of dispersants while recognizing the potential for environmental impacts from the dispersants. Longer term studies conducted by the response and by the trustee agencies regarding the application of dispersants are on-going in support of the NRDA process.

QUESTION #2: Director Westerholm, you have testified that "[t]he use of dispersants is an environmental trade-off between impacts within the water column, on the sea surface (bird, mammals, and turtles in slicks) and on the shore." You have also testified that "the effects of dispersants and dispersed oil below the surface on wildlife such as diving birds, marine mammals, and sea turtles are unknown." How does NOAA assess the tradeoffs if the effects on wildlife and fish in the water column are unknown?

ANSWER:

First, dispersant use at the surface was pre-approved for offshore use by the Regional Response Team (RRT) VI. This was the result of many years of consideration, scientific analysis, and workshops to explore the tradeoffs associated with dispersant use, using all of the processes described in considerable detail in chapter 2 of the 2005 National Research Council (NRC) report, Oil Spill Dispersants: Efficacy and Effects (p.21-50).

In the early days of the Deepwater Horizon response, when underwater use of dispersants was proposed, and during the discussion and initial testing phase of the sea floor dispersant technique (injection of dispersant directly into and at the riser), the Environmental Unit of the Unified Command developed a strategy to assess associated trade-offs. NOAA contributed by undertaking a stepwise multi-agency approach to evaluating risks and benefits of potential long-term use of this method. On May 1, 2010, NOAA's Emergency Response Division (ERD) led a multi-agency review of what was known and unknown. The assessment process included identification of the receptors (habitats and species potentially affected), expected transport and fate of dispersed and undispersed oil, and a monitoring plan that included possible decision criteria for reconsidering (and stopping) the use of dispersants at the sea floor.

It was recognized by all that mitigating the spill would not stop the flow of oil, but might alter the nature of the oil such that there would be a shift in which resources are impacted. Any benefit was viewed in context of a trade-off analysis. NOAA's primary goal was to reduce the overall environmental impact to our natural resources.

During the next several days, the SSC in consultation with trustees provided information on the decision process. A written plan was developed by the Unified Command to describe the path forward. NOAA, as part of Unified Command, wanted to make sure that concerns about possible impacts of oil and dispersants on the surface waters, water column, and sea floor flora and fauna (including eggs and larvae) were addressed in the plan. The proposed actions were not without risks. The unknowns to the overall trade-off discussion were articulated. NOAA required that steps be taken to do the monitoring needed to evaluate environmental impacts of the dispersants and dispersed oil so that we could better understand the threat in the short term before committing to the long term use of this technique. Monitoring needed to extend from the sea surface to the sea floor (some 5,000 feet in depth). NOAA recognized that such a major spill requires tough choices. No options were ideal with the exception of stopping the flow of oil. NOAA recommended that use of dispersant at the seafloor be managed such that monitoring and review of the data would lead to an overall consensus of stakeholder support for any long-term use of this option.

QUESTION #3: Director Westerholm, the National Academy of Sciences in 2005 said that "a particular concern [with the use of dispersants] stems from potential synergistic effects of exposure to dissolved components in combination with chemically dispersed oil droplets." The NAS recommended that federal agencies and other stakeholders "develop and fund a series of focused toxicity studies to determine the mechanisms of both acute and sublethal toxicity to key organisms from exposure to dispersed oil." Has NOAA conducted or found that others have performed acute and sublethal toxicity tests involving dispersants and dispersant-oil mixtures on key organisms in the gulf?

ANSWER:
Yes. NOAA Fisheries scientists have conducted acute and sublethal toxicity tests with sensitive life stages of Pacific herring. This species is not native to the Gulf of Mexico, but is closely related to menhaden, which is native to the Gulf (Barron et al, 2003). Other federal agencies,

industry, and academic scientists have conducted many acute and sublethal dispersant and dispersed oil toxicity tests on sensitive life stages of numerous additional marine and estuarine species, including Gulf of Mexico species such as commercial shrimp and red drum larvae. In fact, two widespread Gulf species (a forage fish and a shrimp) have been commonly used as "reference" test species by ecotoxicologists around the U.S. including by the EPA and internationally. Much of that work also appeared in the National Academy of Sciences 2005 report referenced earlier, and more studies have been published since then.

During the past decade the Coastal Response Research Center (CRRC) at the University of New Hampshire, working under the guidance and oversight of NOAA and other agencies, has sponsored various academic and contractor investigations of the ecotoxicity of dispersants and dispersed oils. Much of this work has appeared in the peer-reviewed literature since NAS 2005. Additionally, NOAA has collaborated in reviews of dispersant and dispersed oil toxicity tests sponsored by other agencies, such as California's Oil Spill Prevention and Response (CalOSPR) agency.

Most recently, EPA conducted and published an evaluation of the toxicity of dispersants and dispersed oil in response to the dispersant use during the Deepwater Horizon event.. As reaffirmed by EPA's study specific to this spill, the toxicity of Corexit 9500 alone is low and the toxicity of oil dispersed with Corexit 9500 is no greater than that of oil alone (http://www.epa.gov/bpspill/dispersants-testing.html).

QUESTION #4: Director Westerholm, the National Incident Command released a report titled: "BP Deepwater Horizon Oil Budget: What Happened To the Oil?" I'd like you to clarify some numbers in this report. Of the estimated 4.9 million barrels of oil spilled, does the report find that 24% of the oil was naturally or chemically dispersed into the water column, and that an additional 26% of the oil remains in the water column? How much oil in any form remains in the water column?

ANSWER:
Improvements have been made to the Oil Budget Calculator since it was first issued on August 4, 2010. The revised Oil Budget Calculator was released November 23, 2010 and adjustments were based on modified calculations and modeling, as well as additional knowledge about the Deepwater Horizon spill provided by the team of contributors and reviewers. This peer-reviewed report is largely consistent with earlier results released by the federal government on August 4, 2010. The most significant change is a doubling of the expected amount of oil classified as "chemically dispersed." This category was revised from 8% to an estimated 16% of total oil chemically dispersed. The revised report estimates that approximately 29% (August 4 report estimated 24%) of the oil was either physically or chemically dispersed into the water column as small droplets. These droplets were then subject to mixing with water and biodegradation by microbes. In addition, some percentage of the oil dissolved into the water column. It is difficult to estimate how much of the oil dissolved because the same components that tend to dissolve are also amenable to evaporation and the rates at which these components dissolved as they moved from the well head through a mile of water is not well understood. As a result, the authors of the revised report estimated that about 23% of the oil either dissolved or evaporated (August 4 report

estimated 26%). Once dissolved into the water column, the dissolved molecules of oil would also be subject to further mixing and biodegradation. The current version of the Calculator estimates the "residual oil" component as 23%, and qualifies this estimate with the belief that, with high confidence, the true percentage should be between 11% and 30%. The previous "residual oil" value in the August 4 report was 26%. This oil might be seen as surface sheen, accumulation on beaches, weathered tar balls in the water column or tar mats on the bottom or buried in sediments. Again, these components would be subject to biodegradation. The full document released on November 23, 2010 can be found at: http://www.restorethegulf.gov/sites/default/files/documents/pdf/OilBudgetCalc_Full_HQ-Print_111110.pdf.

QUESTION #5: Director Westerholm, I have another question on the NIC report. The report states: "All of the naturally dispersed oil and some of the oil that was chemically dispersed remained well-below the surface in diffuse clouds where it began to dissipate further and biodegrade ... Until it is biodegraded, naturally or chemically dispersed oil, even in dilute amounts, can be toxic to vulnerable species ... " Could the oil still in the water column be toxic to fish and wildlife in the gulf?

ANSWER:
When considering the effects of dispersed oil on fish and wildlife, we are concerned about acute (short-term), chronic (long-term), and sublethal effects.

At this time, it is highly unlikely that any oil remaining in the deep water column (1100 to 1300 m) is at concentrations acutely toxic to fish and wildlife, because:
(1) it has been degrading;
(2) the concentrations of total petroleum hydrocarbons (TPH) have been declining over time and with distance from the source since the oil release ceased and were largely below concentrations known to be acutely toxic to sensitive life stages (eggs, larvae) of fishes and invertebrates even at the maximum well discharge levels and the height of the subsea dispersant application activities;
(3) the components of the oil that remain will be largely comprised of the less acutely toxic, but more persistent higher molecular weight hydrocarbon components;
(4) the majority of wildlife species (birds, mammals and turtles) are not known to enter waters deeper than about 800 meters, with the exception of whale sharks which dive to depths of about 1,000 meters; (5) oxygen used by microbes during biodegradation was not consumed at rates that resulted in hypoxia in deep water;
(6) the scale (size) of the formerly contaminated deep water mass is small compared to the geographic area (range) over which the wildlife species (birds, mammals and turtles) are found in the Gulf; and
(7) the dispersed oil is being continually diluted as it spreads in the three dimensional space of the deep ocean (vertically, horizontally, and laterally), with each bit of dilution resulting in a lower dose and exposure of the dispersed oil to the organisms that encounter it.

Long-term research on chronic and sublethal effects of oil on fish and wildlife is ongoing as part of the Natural Resource Damage Assessment.

Senator Bernard Sanders

QUESTION #1: You mentioned there are no data on toxicity of dispersed oil to deep-sea biota at any life stage. How were initial test results on Gulf of Mexico dispersants obtained? In other words, were these tests conducted at the wellhead so that depth, pressure, and temperature variables were accurate?

ANSWER:
Scientific methods of ecological risk and hazard assessment have been developed in a way that the tests on certain species allows for extrapolation to untested species (such as those living at depth, under pressure, and in cold temperatures at the wellhead), similar to the methods used to extrapolate pharmaceutical risks from laboratory test animals to humans. The dispersants, Corexit 9527 and 9500, along with dozens of others, as well as dispersed oils, have been tested for acute and chronic toxicity to aquatic, marine and estuarine organisms over many years. We have used these risk assessment techniques, such as species sensitivity distributions (SSDs) to identify the lowest concentrations that are toxic to the most sensitive species and life stages tested to date.

Acute toxicities at the low temperatures encountered in deep water (4 to 5 °C) have been tested using cold water and arctic marine organisms such as crab larvae, juvenile cod and other arctic and sub-arctic species. These species and life stages are no more or less sensitive than the majority of non-arctic species used for many years to evaluate dispersant and dispersed oil toxicity. Tests were not conducted at the wellhead, and not with deepwater species such as myctophids, hatchetfish, or daggertooth.

Research on long-term chronic and sublethal effects of oil on fish and wildlife is ongoing as part of the Natural Resource Damage Assessment.

Senator Kirsten E. Gillibrand

Water Samples and Biodegradation of Dispersants

According to data obtained from Unified Command, application of Corexit 9527, which contains a potentially hazardous ingredient, 2-butoxyethanol, was stopped on May 22nd. Though application was stopped, water sampling results posted on EPA's website and collected along the shoreline of the Gulf Coast indicate the presence of 2-butoxyethanol on July 8th, 47 days after the last known application.

QUESTION #1: Has NOAA investigated the potential source the 2-butoxyethanol? Is there evidence to correlate the presence of 2-butoxyethanol with the application of Corexit 9527? If so, does this mean that this dispersant is more persistent in the environment than initially expected? If not, what other sources may account for the presence of 2-butoxyethanol in the samples?

ANSWER:
During the BP Deepwater Horizon oil spill response, no dispersant operations were conducted along the shoreline of the Gulf coast. The closest operation was in open water, 7.8 miles SE of Pas A'Loutre/Birdsfoot area. Otherwise, most dispersant application was 40 to 50 miles away

from the shoreline. Therefore it is highly improbable that the dispersant operations either at the surface off shore or in deep water, were the sources of the 2-butoxyethanol reported by EPA.

SMART monitoring and transport modeling indicate that dispersed oil materials quickly declined in concentration within the dispersion zone, and dispersed oil concentrations declined quickly to the parts per billion level as the near-surface plumes spread and degraded.

Other sources of 2-butoxyethanol could be from use of common household cleaners and products. For example, 2-butoxyethanol is a significant component of household glass cleaner. It is also used in varnishes, "quick drying" varnishes, lacquers, enamels, solvent for nitrocellulose resins, dry-cleaning compounds, spot removers, and varnish removersThe use of 2-butoxyethanol is permitted by FDA under prescribed conditions of use as an indirect food additive (for example in sanitizing washes for food processing equipment, washing of fruits and vegetables, as well as various uses in adhesive, and paperboard manufacturing.) (note: FDA has determined that it is safe for its approved intended uses and the human exposures associated with those uses). Any of these products could get into nearshore waters via several routes including unauthorized direct dumping, stormwater runoff, permitted wastewater discharges, marina and boat maintenance operations, etc. It is also relevant to note that various components of dispersants (other than 2-butoxyethanol) are also found in cleaning and personal care products, and two of the components, propylene glycol and dioctyl sulfosuccinate sodium salt, are generally regarded as safe (GRAS) for use as food additives under prescribed conditions.

<u>Dispersant effectiveness on fresh versus weathered oil</u>

Throughout the response, federal authorities have proposed that oil takes about 3 hours to travel from the subsurface to surface. On at the surface, federal authorities have said that it take about 5 hours for oil to weather.

QUESTION #2: A number of BP's exemptions for surface/subsurface use seemed to rely on the identification of oil plumes a day to a week in advance. As a result, exemption requests were submitted anywhere from a day to a week in advance. If the time windows proposed by federal authorizations for oil weatherization are correct, it appears that dispersants were applied to weathered oil where the effectiveness had drastically decreased. What have we learned about the effectiveness of dispersants at breaking up weathered oil?

ANSWER: Dispersants applied subsurface were being applied to fresh oil at the wellhead. Laboratory studies and past experience in the Gulf indicate that fresh oil of this type is dispersible using the kinds of dispersant that were applied. Surface application was more challenging because of the weathered state of the surface oil. In the early days of the spill, dispersants were applied to oil in various stages of weathering to determine the effectiveness of dispersing weathered oil. As the spill progressed, information gathered from those early dispersant missions was used to identify target areas for dispersion. Dispersant operations were generally planned on a next day planning cycle with the identification of target areas and associated review. As a result, dispersants were normally applied to relatively fresh oil (brown or black) oil. However, studies by two widely recognized oil spill consultant laboratories (S.L. Ross, and SINTEF) determined that the surface oil was dispersible, even after some weathering.

Moreover, water samples taken as part of the SMART protocols showed dispersed oil in the surrounding water after surface application. Results of these studies can be provided to the Senator upon request.

Senator James M. Inhofe

QUESTION #1: From your vantage point, is it fair to say that federal agencies took into account potential damages from dispersants and came to the conclusion that any negative effects from their use would more than likely outweigh those of oil spewing into the Gulf?

ANSWER:
Due to the unprecedented nature of this spill, it was determined that multiple response technologies needed to be employed for a successful operation, including burning, skimming, booming, and dispersant application. The overall goal of a spill response is to use the response tools and techniques that will minimize the overall environmental damage from the oil. The use of dispersants is an environmental trade-off between impacts within the water column, on the sea surface (birds, mammals, and turtles in slicks) and on the shore. Use of dispersants offshore and in deep water reduced the amount of oil reaching the shoreline, reduced the amount of shoreline cleanup that will be required, and helped to reduce recovery time of injured nearshore resources. Dispersants helped mitigate shoreline impacts along the Gulf coast from the Deepwater Horizon BP oil spill.

QUESTION #2: Judging from the current reports that dispersants have been successful in the Gulf, with no discernable concomitant environmental damage, would you support a moratorium on the use of dispersants for further study should we need them again in the near future?

ANSWER:
No. We do not believe that there should be a moratorium on the use of dispersants until further studies have been completed. There are data gaps that we should work to fill, but many of those will be addressed in the wake of this spill through the NRDA process as well as the vast amount of academic research that is getting underway. Our position is that dispersant use on this spill was effective, thereby resulting in far fewer habitat impacts than otherwise might have occurred. This is in line with the results from the Coastal Response Research Center CRRC dispersant workshop held in May 2010 (http://www.crrc.unh.edu/dwg/dwh_dispersants_use_meeting_report.pdf). The consensus from the workshop participants is that the 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 water surface and become entrained into the sensitive wetlands and near shore coastal habitats. A notable exception may be to the blue fin tuna population where additional assessment work is on-going. In general, we believe that there is a risk to a fewer number of offshore species, rather than the multitude that would be impacted if the coastal habitats were severely oiled, damaged or destroyed. The 50 scientists, who participated in the May CRRC dispersant meeting in Baton Rouge, supported dispersant use during the BP Deepwater Horizon oil spill, noting that its use had merits during the response.

As noted in earlier responses, there is a large body of scientific literature regarding the toxicity of dispersants, particularly Corexit 9500, and the effects of chemically dispersed oil. In addition, there have been numerous consensus ecological risk assessment workshops around the United States and its territories which have examined the trade-offs associated with dispersant use (among other response options). Many of the regional response teams (RRTs) have zones established where the use of dispersants as a response tool is pre-approved, including RRT VI.

QUESTION #3: A recent St. Petersburg Times article reported that members of the University of South Florida scientific community as well as an oceanographer from the University of Southern Mississippi questioned certain NOAA data and claimed that when they presented their findings they were "lambasted", "basically called inept idiots" and attempts were made to discredit them. Can you speak to the scientific nature of the USF and USM findings and can you address the claims of NOAA's reaction to their findings?

ANSWER:
During the emergency response phase of the spill, it was appropriate for NOAA to be cautious in responding to media reports citing observations for which data had not been made available or independently verified. The article quotes Dr. Lubchenco saying that NOAA and others asked "for people to stop speculating before they had a chance to analyze what they were finding." NOAA cannot comment on the scientific nature of the USF and USM findings because to date, the complete dataset has not been shared publicly.

NOAA has endeavored to work very closely with our academic partners to get a more comprehensive scientific view of the Gulf and has consistently encouraged data sharing. Much of our data is available on http://www.noaa.gov and on http://www.geoplatform.gov. The agency acknowledges the need for partnerships and leveraging resources to meet common goals. NOAA has engaged the academic community through several channels, such as providing direct support, asking PIs to serve on research cruises, embedding them on operational teams at the Command Post, and hosting multiple conferences. In messages to academics and in public, NOAA has consistently focused on the science and acknowledged our partners' work.

QUESTION #4: Has NOAA seen any evidence of dispersants bioaccumulation in any species in the Gulf?

ANSWER:
The Corexit products are among the most studied dispersants in use today with a solid body of scientific research and published literature covering at least the last 20 years. From that previous testing and published results, its composition and behavior, its level of toxicity to numerous organisms, and its rate of degradation under specific conditions is known. The dispersant degrades on the order of days to a few weeks (EPA memo to the Oil Science Advisory Team (OSAT) of Deepwater Horizon Unified Command, 2010 and Overton, E., 2010). The last dispersant application was on July 19th. Due to its solubility, its rapid dilution in a three dimensional environment, and its rapid rate of degradation, we would not expect it to persist in

the environment long enough to manifest itself in seafood and testing has confirmed this expectation.

Experts trained in a rigorous sensory analysis process have been testing Gulf seafood for the presence of contaminants, and every seafood sample from reopened waters has passed sensory testing for contamination with oil and dispersant. Building upon the extensive testing and protocols already in use by federal, state and local officials for the fishing waters of the Gulf, NOAA and FDA have developed and are using a chemical test to detect dispersants used in the Deepwater Horizon-BP oil spill in fish, oysters, crab and shrimp. Trace amounts of the chemicals used in dispersants are common.

To ensure consumers have total confidence in the safety of seafood being harvested from the Gulf, NOAA and FDA have added a second test for dispersant when considering reopening Gulf waters to fishing. The new test detects dioctyl sodium sulfosuccinate, known as DOSS, a major component of the dispersants used in the Gulf. DOSS is also approved by FDA for use in various household products and over-the-counter medication. The best scientific data to date indicates that DOSS does not build up in fish tissues.

Using this new, second test, in the Gulf scientists have tested 1,735 tissue samples including more than half of those collected to reopen Gulf of Mexico federal waters. Only a few showed trace amounts of dispersants residue (13 of the 1,735) and they were well below the safety threshold of 100 parts per million for finfish and 500 parts per million for shrimp, crabs and oysters. As such, they do not pose a threat to human health.

For more information see: http://www.noaanews.noaa.gov/stories2010/20101029_seafood.html

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Senator WHITEHOUSE. Chairman Boxer.

Senator BOXER. Thank you.

Thank you both. I agree with Senator Barrasso's comments that there were tough choices to be made as to how you deal with this. And you had to look at everything that was available.

I do, however, have some questions about the dispersants themselves. And I guess I am going to ask the EPA to comment, and then of course if NOAA has a comment as well.

My understanding is that Corexit 9527 was the first dispersant that was used. Is that correct?

Mr. ANASTAS. That is correct, Senator.

Senator BOXER. Then after 30 days they switched to Corexit 9500?

Mr. ANASTAS. That is correct.

Senator BOXER. And I have here the company's data sheet on these two choices here. And the first one, the hazardous ingredient—and I may not say it right, I will try, butoxyethanol. That was the first one. And my understanding is that it is a known hazardous substance that causes liver and kidney damage and internal bleeding, is that correct, if there is over-exposure?

Mr. ANASTAS. Yes.

Senator BOXER. Then the switch was made to Corexit 9500, and the active ingredient then was light petroleum distillates, basically kerosene. Is that correct?

Mr. ANASTAS. That is not an active ingredient. It is a solvent in the formulation.

Senator BOXER. But is that the main part of it, the kerosene?

Mr. ANASTAS. The petroleum distillates is a fraction of oil, like kerosene, it is not an active ingredient, it is the solvent.

Senator. OK. Well, are you aware that on their own sheets, they describe their own product, human health hazard, they define it as acute in each case. Are you aware of that?

Mr. ANASTAS. Yes.

Senator BOXER. And were you on the ground, was BP or the Coast Guard, who was in charge as far as you know, letting people know about the warnings that are on these substances?

Mr. ANASTAS. On the ground, I believe that there was, all of the available information was being shared, to the best of my knowledge.

Senator BOXER. To whom?

Mr. ANASTAS. To the people on the ground.

Senator BOXER. OK. Because it is important to note that in the case of Corexit 9527A, it said, repeated or excessive exposure may cause injury to red blood cells, kidney, or the liver. Do not get in eyes, on skin, on clothing. Do not take internally. Use with adequate ventilation. Wear suitable protective clothing. Flesh-affected areas, keep away from heat, keep away from sources of ignition.

And the other, it says, keep container tightly closed, do not get on eyes, skin, or clothing. Avoid breathing the vapor. Use with adequate ventilation. In case of contact with eyes, rinse immediately, seek medical advice. After contact with skin, wash immediately.

I make these points because the companies themselves have indicated there is an acute risk to human health. And so I want to make sure that we were letting people know. But to your knowledge, people were made known?

Mr. ANASTAS. Yes. And also that OSHA was aware of these issues, and addressed them.

Senator BOXER. OK. My understanding is that there are some communities involved here that are suing Corexit, because of—do you have that paper, because I don't have it in front of me now. I will come back to that—here it is. Sorry. A personal injury lawsuit involving the chemical dispersant Corexit 9500 was filed in Alabama, where two Gulf Coast residents of Alabama and property owners allege that BP's use of the product is causing people to get sick.

Do you know, do either of you know, that people in Alabama have claimed that they have gotten ill and what those symptoms could be?

Mr. ANASTAS. I will just say that I have seen those reports reported in the media, yes.

Senator BOXER. But have you—do you know any more about that, what these symptoms are?

Mr. ANASTAS. I have seen reported that people are reporting rashes. That people are reporting rashes and redness. People are reporting those effects.

Senator BOXER. And in Alabama and Louisiana and different places?

Mr. ANASTAS. Yes.

Senator BOXER. How many people do you think have——

Mr. ANASTAS. I do not have any numbers.

Senator BOXER. Anything, do you know?

Mr. WESTERHOLM. No, I don't know.

Senator BOXER. Then, a group of Louisiana oystermen are claiming that Corexit 9500 is four times more toxic than the oil itself. Do either of you believe that statement is true?

Mr. ANASTAS. I have no data to support that statement.

Senator BOXER. Do you know whether Corexit 9500 is more toxic than the oil itself?

Mr. ANASTAS. I have data that I actually just reported that shows that the Corexit and the tests that we ran, on aquatic species, is less toxic than the oil itself.

Senator BOXER. OK, so you disagree with them. Did you test it at different levels? What level did you test it at?

Mr. ANASTAS. Yes, this went across a wide range of concentrations, many different levels, all the way from parts per billion——

Senator BOXER. What was the lowest concentration that you tested it at?

Mr. ANASTAS. Parts per billion.

Senator BOXER. Did you consistently test at parts per billion?

Mr. ANASTAS. So, what we did is we tested at parts per billion, and then you keep on increasing the concentration until you see a toxic effect. The way that these tests were run is that you continue to increase the concentration until your test species show a toxic effect.

Senator BOXER. OK. I am going to place in the record a document from the Department of Health and Hospitals of Louisiana which says in summary, in Louisiana there have been 334 reports. This is between, this is week 30 of the spill, ending July 31, 2010. There have been 334 reports of health complaints believed to be related to exposure to pollutants from the oil spill. Two hundred and fifty reports came from workers and 84 from the general population. Most frequent reports include headache, dizziness, nausea, vomiting, weakness, fatigue, upper respiratory irritation. Seventeen workers have had short hospitalizations. The general population complaints were related to odors.

[The referenced material was not received at time of print.]

Senator BOXER. I am concerned about the workers who got close to it. But you are saying that because, if you read these reports, I would also put in the record the reports from NALCO, the company itself.

[The referenced material was not received at time of print.]

Senator BOXER. You are saying that to your knowledge, the workers were warned; they had to wear protective gear, and they knew about this.

Mr. ANASTAS. I am saying that I know that OSHA was actively involved in informing workers.

Senator BOXER. Well, that is important.

Last question, and then I will stop. In the *Exxon Valdez* case, in the impact on the fisheries, which Senator Barrasso was so right, we have to protect the jobs that are related to fishing, recreation, tourism, it took a long time to learn that some of the fisheries, especially the herring population, was just decimated. People lost everything. Because Exxon sued for 20 years, and at the end of the day the average recovery for these people was just minuscule.

So it took very long to find out the impact on the fisheries. Do we know—I would ask NOAA whether we know today that the fisheries are going to be fine, or do you think it is going to take time to know how much time, and are you continuing to monitor the various fisheries there?

Mr. WESTERHOLM. Senator, let me start with the last question, which was, are we monitoring, and the answer is yes. Then you asked how much time. I don't think I would be able to speculate at this time how much time it is going to take us to actually do all the testing necessary to see how fast those fisheries recovered.

But certainly there was baseline data that was taken to compare it against, which was pre-spill or outside of the spill zone. We have historic data. And so what we are going to be looking at is a number of species and the impact on that, and the fishermen over the course of the next years.

Senator BOXER. And what is your monitoring showing at this stage? Is anything showing up? Do you feel good about what you see?

Mr. WESTERHOLM. As you may be aware, at this point we still have a lot of the area of the Gulf, at least in Federal waters, that are closed to fishing. So some of the samples are just being collected now to see if it is safe to reopen those areas. So I think it is premature, again, to show if there was an impact of oil or dispersant on it.

Senator BOXER. When do you think you will be able to make your first judgment on the state of the fishing industry?

Mr. WESTERHOLM. In those first, we have opened one area. Over the next month or so we will be able to get information on that.

Senator BOXER. Good. And will you send us these monitoring results?

Mr. WESTERHOLM. Yes. In fact, they are being posted as we get them on our Web site and on geoplatform.gov.

Senator BOXER. Thank you.

Senator Barrasso.

Senator BARRASSO. Thank you very much, Madam Chairman.

If I could start with the EPA.

Do you believe that the EPA has all the necessary ability right now to test, to research, and to understand and mitigate any negative impacts from the use of dispersants in the Gulf without additional legislation from Congress?

Mr. ANASTAS. I think the Administrator has made it clear and stated publicly that when we look at the lessons learned that we do need to look back at how the National Contingency Plan brings us in the data that we need, the information that we need in order to make sound decisions going forward. I do believe that that is something that the Administrator has said on the record, and I agree with that.

Senator BARRASSO. You had a statement August 2nd, during your phase two testing of the dispersants, and you said the dispersants are working to keep oil away from the shore. You said dissolved oxygen levels have not fallen below levels of concern to aquatic life. You said dispersant plus oil mixtures have roughly the same toxicity as the oil itself, and that dispersants are less toxic than the oil being released into the Gulf.

Would you go further to say that the use of the dispersants has been effective in terms of combating this oil spill and that it was the right call at the time, to the extent of the spill, to use the dispersants?

Mr. ANASTAS. The decision to use dispersants was a decision not taken lightly. Any time you are faced with adding substances into an ecosystem like the Gulf of Mexico, that is something that needs to be done thoughtfully, and that is why the constant monitoring was put in place, and the thoughtfulness was put in place.

That said, when you look at all of the tools to combat this tragedy, the skimming, the burning, the oil recovery, the containment, dispersants have shown to be one important tool in that tool box in the response.

Senator BARRASSO. I want to just read a quote if I could from EPA Administrator Lisa Jackson, and then at the end ask whether you agree with it. She said "Science tells us that dispersants can help protect these invaluable resources by breaking up the oil and speeding its natural degradation offshore." She said "We also know that dispersants, which are less toxic than oil, break down over a period of weeks rather than remaining for several years, as untreated oil might."

Do you agree with her comments and statement?

Mr. ANASTAS. I agree with the statement of the Administrator.

Senator BARRASSO. Great.

If I could go to NOAA, you said in your testimony that the response to date has been successful in limiting the shoreline impacts. You also said that no response method is 100 percent effective. So given the statements about the shoreline impacts, are the critics of the responders who use dispersants trying to make the perfect the enemy of the good here?

Mr. WESTERHOLM. That is a great question. I think I like to use the analogy of—and we talked about lesser of two evils. I don't know that I especially like that quote. But I like to use the analogy of maybe a medical doctor making a diagnosis on a particular disease, possibly cancer, where you have a lot of options, radiation, cut it out, chemotherapy. Over the years we have learned more and more and are able to apply better science to it. But at that moment in time you have to make the decision. You make that decision based on any number of options you have and tools that you have to combat it.

So I would say that the decision, as Dr. Anastas pointed out, is not taken lightly, and that the Unified Command made that decision with a lot of factors in mind, which included the economic and ecological impacts that could have occurred or would likely occur without the use of dispersants, some of which were unprecedented in terms of deep, sub-sea, deepwater injection of dispersants.

But I think in the aftermath of that, it would be difficult for me up here to second guess the decision process that was going on down there when given all the information that they had. So to answer your question, I believe that the application of dispersants, based on what we know about the other methodologies, did prohibit some of the oil from getting to the shoreline. The actual long-term impact and all that still needs to be studied, and in the future additional research will help us make those better decisions.

Senator BARRASSO. Great, thank you.

Thank you, Mr. Chairman. It looks like my time is expired. Thank you.

Senator WHITEHOUSE. Thank you, Senator Barrasso.

I hope that witnesses and the audience will forgive the constant bustle in and out of the Committee. We have two votes happening back to back on the floor. So I just rushed over to vote on the first one, and that will continue, and I will have to rush over and vote again, and people are going over to make their votes. Because there are two of them, there is going to be a lot of back and forth.

So just by way of explaining, it is nothing you are saying that is causing us to jump up and rush out.

I went down to visit the Gulf and the Coast Guard folks who took us around talked a lot about how the use of Corexit as a dispersant, they used the word approved over and over, it was sort of part of the mantra, it is an approved dispersant.

And I have a question about the way that the dispersants get deployed and how that approval process works. Because it doesn't seem to me, at least I can't see a point at which one agency actually takes a look at a dispersant and gives it its blessing and says, OK, this is actually approved. There is kind of approval creep, and eventually people say it is approved. But I don't know at what point anything actually gets done to make it approved.

Here is what I understand the process is, and correct me if I am wrong. Under the National Contingency Plan, there is a product schedule of dispersants that can be used. EPA maintains that product schedule, correct? In order to get a dispersant onto that product schedule, the manufacturer nominates it onto the list, correct?

Mr. ANASTAS. Correct.

Senator WHITEHOUSE. And the test that is done is a test of effectiveness, that it has to be more than 45 percent effective, however that is measured, at dispersing oil, is that correct?

Mr. ANASTAS. Correct.

Senator WHITEHOUSE. But there is no testing of any kind that is done about its toxicity or its health effects at that time by EPA?

Mr. ANASTAS. The data that is submitted to EPA includes acute aquatic toxicity data.

Senator WHITEHOUSE. But there is nothing done by EPA. It is part of the filing by the company to put some toxic quality information in the filing. But EPA doesn't do any evaluation or assessment. It could be as toxic as all get-out, and it still goes on the list as long as it meets the 45 percent effectiveness threshold.

Mr. ANASTAS. It is part of the filing.

Senator WHITEHOUSE. It is a notice filing, basically at that point, not an approval at that point.

Mr. ANASTAS. That is correct. It is part of the filing. I want to emphasize that while I am not an attorney, and I will be happy to get answers to any process questions to you, yes, it is part of the filing of the data that is submitted.

Senator WHITEHOUSE. And that is why the National Contingency Plan explicitly states that having a product on the product schedule does not constitute approval by the EPA.

Mr. ANASTAS. It is a listing on the NCP list.

Senator WHITEHOUSE. Yes. Not an approval of any kind, because, except as to the question of effectiveness, the 45 percent threshold.

Mr. ANASTAS. That is the threshold, correct.

Senator WHITEHOUSE. Right. So then it is on the list, and now you have an incident, and now the Federal on-scene coordinator has the ability to take dispersants that are on the list and determine which is appropriate for us, and then apply those dispersants.

Mr. ANASTAS. Correct.

Senator WHITEHOUSE. The Coast Guard folks were describing the list as being an approved list. And when I asked them, they said that they did not do any approval of the list. In fact, they took the entire list and said, everything on it is approved for use, as best I can tell. Is that correct?

Mr. WESTERHOLM. Senator, I might make one point of clarification here. There is an interim step that was left out. Any type of alternative technology, which would include dispersants or in situ burning, would have to go through the Regional Response Team.

Senator WHITEHOUSE. Go through the RRT process.

Mr. WESTERHOLM. And in that process, both the Coast Guard and the EPA are co-chairs. They will submit that to other Federal agencies. But each of the States are also in the Regional Response Team. And the Federal trustees, NOAA and the Department of Interior. At that point, the Regional Response Team can do a pre-approval for use of dispersants in a certain location. Usually it is offshore. And they make that for expediting decisions.

Senator WHITEHOUSE. And they did that in this case.

Mr. WESTERHOLM. They did that in this case.

Senator WHITEHOUSE. They did that for the entire product schedule.

Mr. WESTERHOLM. If they decide not to do that, then on a case by case basis the Federal on-scene coordinator, with the exception of certain emergencies which would include peril to human life, would have to go through that RRT process for that approval step. So in this case, it was approved, the use of dispersants. And that the FOSC had that pre-approval in place. And at that point the final decision would have to be made by the Coast Guard.

Senator WHITEHOUSE. Here is my question about this. When the RRT process pre-approved the entire product schedule of all dispersants, obviously that accelerated everything that the Federal on-scene coordinator could then do, because they would not have to go back through that secondary process that you described of case by case approval, correct?

Mr. WESTERHOLM. Right.

Senator WHITEHOUSE. But what a lay person would consider to be an approval, that this particular chemical is safe for use in these circumstances, never anywhere in this process that I can see actually gets done. There are three steps. The first step is the filing by the manufacturer that provides toxicity, some toxicity data. Then there is the selection by EPA which is based only on effectiveness. It has nothing to do with toxicity.

Then you have the RRT pre-approval, so-called. But in that case, there was no examination done of which might be better or worse. They just took the entire list and said, you are all in. And so if you are looking at, for instance, Corexit 7526 or a specific product, it strikes me that to use the word approved about it may be technically true, because it technically was in the RRT pre-approval process. But what a regular human would think of as something having been approved never actually happened. Nobody ever actually looked at that and said, you know what, that is too toxic to use in these circumstances. Or is more or less toxic than the other.

That is why after the fact you had to do the relative toxicity testing, after they had all been pre-approved, correct?

Mr. WESTERHOLM. And I think that is a great point. I think one of the issues that the RRT does look at is the collective of all those dispersants, saying if you picked any one of those, would it be safe to use in this particular environment. That is what they approved. They didn't pre-select any given dispersant. Once it made the list, they had to treat that list as a collective. And your point being, it may be appropriate to differentiate within that list.

Senator WHITEHOUSE. It may be appropriate to differentiate within that list, and it may be important to have somebody other than the manufacturer in a basically unreviewed disclosure of certain toxicity data come to a decision about the safety or not of the product.

Let me put it this way. I can't think of another circumstance in which a regulatory agency approved something for use without actually coming to a formal decision that it is safe to be used and without any process other than that the manufacturer provides some information that is then posted. There didn't appear to be an evaluating moment.

Mr. ANASTAS. Senator, you are making an extremely important point. You are certainly correct that the National Contingency Plan outlines the listing criteria, what needs to be submitted in order to be on the list.

Senator WHITEHOUSE. And particularly when you have what the Administrator referred to as a real emergency going on, the time at that point for the RRT process to go through a scientific evaluative process of determining what the toxicity consequences are off of the public data that has been filed is, you are under a lot of pressure at that point. It is a little hard to say, sorry, BP, sorry, Mr. President, we are not ready to authorize the use of dispersants here because we need to do a little bit more studying, because we haven't done that yet. You kind of have to say, well, here is what we have; take your best shot.

And it sounds like that is more or less what happened. Is that correct?

Mr. ANASTAS. And I think your point speaks directly to the fact that we want to have more science, more data, more testing up front. So when we are making decisions in an emergency situation you have that data, you have that perspective at your fingertips.

Senator WHITEHOUSE. How are you going to build that in? What is going to happen to this process so that an evaluation moment by somebody in Government takes place before a chemical gets dispersed into the environment with the nominal word approved attached to it, which I think led a lot of people to believe this stuff is safer than it actually is?

Mr. ANASTAS. Administrator Jackson has said publicly that we need to go back to look at how the NCP is currently structured, to look at how we get more science, how we get more data, how we get more information into this process, so that it is far more transparent, far more informative. I think we are looking forward to bringing those proposals and recommendations forward.

Senator WHITEHOUSE. So reforming that administrative process is something that is underway within EPA?

Mr. ANASTAS. That is correct.

Senator WHITEHOUSE. OK. That is very good to hear. I appreciate that.

The other issue that comes up that I think is sort of an obvious one, but also a related one, is that when you have a toxin in the environment there is the immediate or acute effect that it could have, and you are able to test for that because it is immediate and acute, and you have done so. But an equally common and dangerous way for a toxin to get vectored into humans is through bioaccumulation. And why don't you just briefly describe what bioaccumulation is, and then I will go on with my question.

Mr. ANASTAS. Certainly. Based on the properties that a chemical has, such as how soluble it is in water or how soluble it is in fat or tissues, a chemical has the potential to build up in the body, whether it is of wildlife or fish. A chemical that does that would be considered bioaccumulative.

Senator WHITEHOUSE. And bioaccumulation can be a very powerful and concentrating force if the ultimate animal to which the human is exposed is at the top of the food chain, and it is eating animals that are in turn eating animals that are in turn eating animals that are in turn eating animals that are becoming exposed to the chemical and taking up the chemical. And now you have very, very high levels of concentration at the apex, correct?

Mr. ANASTAS. Substances that are bioaccumulative can, as you describe, go up the food chain. That is a process known as biomagnification. If a substance were bioaccumulative it could be magnified so that you would have higher concentrations at the top of the food chain.

Senator WHITEHOUSE. Magnified by what order of magnitude?

Mr. ANASTAS. Several orders of magnitude.

Senator WHITEHOUSE. In each layer?

Mr. ANASTAS. Throughout the food chain.

Senator WHITEHOUSE. Throughout the food chain. So it could be a thousand or ten thousand times more concentrated at the top of the food chain than it is in a creature at the bottom of the food chain?

Mr. ANASTAS. That is the biomagnifications process. Now, I do think we need to speak specifically about whether or not that is happening with the dispersants.

Senator WHITEHOUSE. Let's do that.

Mr. ANASTAS. OK. Because one of the things that we are very concerned about is bioaccumulation and biomagnification, as I am sure NOAA is as well. We first, of course, did the modeling data, all of our computer modeling results, and showed that these substances, all of the active ingredients of the dispersants, were not bioaccumulative. We also then sought to verify that with empirical data and monitoring data.

So what we are seeing is in our near shore, far away from the shore, deep sea that NOAA can speak to, we are seeing none of the components of the active ingredients of the dispersants persisting or bioaccumulating, certainly not biomagnifying. So we are following the data, and right now the data is telling us that we are not seeing that happen with the dispersants.

Senator WHITEHOUSE. Would you be expecting it to happen this soon after the exposure?

Mr. ANASTAS. Yes. Looking at the chemical structures of all the constituents of the dispersants, it is not surprising to me that these are not bioaccumulating.

Senator WHITEHOUSE. If they are not chemicals that tend to bioaccumulated by their nature. And so it is consistent with what you are seeing in the field, that there is not bioaccumulation happening in any great degree?

Mr. ANASTAS. Right. The best scientific knowledge, intuition, if you will, would suggest that they would not. The modeling data and the monitoring data support that conclusion.

Let me, if I may, Senator, just add.

Senator WHITEHOUSE. Please. At this point it is just the two of us, so I can go well beyond my time limit, and I am happy to have this conversation. When somebody else appears, I will yield.

[Laughter.]

Mr. ANASTAS. I am purposely focusing on, as I often say, the data, the data, the data. Because I think that it is very important to focus on what it is that we know, what the data is telling us and how we get informed by the data. I am not suggesting that we have perfect knowledge, I am not suggesting that we don't need more information and more monitoring. I am actually saying straight out that it is important to keep on asking these hard questions.

Senator WHITEHOUSE. Let me ask a different question which relates to the combined effect of dispersants and oil. As I understand it you have done some studies of the dispersants by themselves and showed that in some circumstances they are disruptive of endocrine in some species, if you will, some cells. But that when you try to test or if you tried to test the dispersant oil combination and do the same endocrine disruption test, the damage of the combined oil dispersant mix is so great on the sample that you can't pick out of the damage any endocrine disruption because the cell damage is so acute and so quick that there is nothing left to test for endocrine disruption.

That strikes me as a potential signal, anyway, that whatever we may know about the effects of the dispersants on their own that there may be different health effects once the dispersants bond with the oil, which I understand it is their nature to do; that is why they work. They bond with the oil and form a sort of a connection between the oil and the water. So that a creature that is taking up the dispersant is also very likely to be taking up, to some degree, oil as well. And in combination the two are far more dangerous than the dispersant alone. Is that all correct?

Mr. ANASTAS. Let me clarify, Senator. In the tests that we ran on the dispersants alone there was a range of tests which included a screening for endocrine disruption. Across the various tests for endocrine disruption we saw in only two of the dispersants a very weak signal, in one of the many tests that we ran on endocrine disruption. And it was not found to be scientifically significant for endocrine disruption.

So I think it is important to say even in the dispersants alone, what we found was not scientifically significant for endocrine disruption.

Senator WHITEHOUSE. You found indication of endocrine disruption, but not scientifically significant endocrine disruption, or not a scientifically significant signal of endocrine disruption?

Mr. ANASTAS. Not a scientifically significant signal of endocrine disruption. When we tried to use that same screening protocol for endocrine disruption on the oil itself and of course on the oil and dispersant, the structure of the tests themselves didn't allow for that. The way that these tests were set up would not allow for any significant results on endocrine disruption.

Senator WHITEHOUSE. And the reason we were told for that is because the damage to the cells is so immediate and so acute that you can't pick up endocrine disruption. They are more or less destroyed, and there is nothing to test.

Mr. ANASTAS. The way that you need to expose these cells is in a way and at a concentration that would not allow for the test to be successfully conducted.

Senator WHITEHOUSE. To go back to bioaccumulation, once you have combined the dispersants and the oil, and now it is being taken up by the bottom level food chain species together, are you equally confident that the bioaccumulation problem is as minimal as it is for dispersants alone?

Mr. ANASTAS. Well, I should certainly let my colleague from NOAA speak to that as well. What we are seeing is that the dispersed oil appears to be—to the degree it resides at all, it is residing as neutrally buoyant. So not at the bottom of the ocean. Our models are not currently able to model bioaccumulation of the oil plus dispersant. It is the monitoring data, the actual data that we are seeing, that is showing that it is not persisting in bioaccumulating.

So the oil plus dispersant, we are not seeing, we are not detecting that in our monitoring.

Senator WHITEHOUSE. And I guess that goes back to the question I had earlier, would you expect to be seeing it at this point, or is the time delay for bioaccumulation such that you would really only see the more pronounced effects months, years, even decades later as the original cohort of bottom of the food chain species got gradually eaten and began to concentrate, and then the things that ate them got eaten, and it concentrated another level up and so forth? That seems to have a time component to it, unless things are being eaten a lot faster than I think out there.

Mr. ANASTAS. So the persistence of the chemicals, the oil and the dispersant, is what is being monitored. I should let my colleague from NOAA speak to what is being seen or not being seen.

Senator WHITEHOUSE. Mr. Westerholm, you have been handed the ball.

Mr. WESTERHOLM. And I will take it. I would go back to what I said earlier; it would be remiss if we said that we knew everything about this situation and would be able to address your question adequately for every species. Certainly for some of the higher order species we are not seeing the bioaccumulation in the tissues, and we might find some in the bile. Most of it is excreted. This would include the oil and the——

Senator WHITEHOUSE. But would you expect to yet? I mean, is this even the feeding season for some of the species?

Mr. WESTERHOLM. You would expect to see it residing in—if it was going to bioaccumulated, you would be able to see that at a level, and certainly in past studies.

Senator WHITEHOUSE. What are you doing to test for that, just so I understand?

Mr. WESTERHOLM. Certainly on the seafood safety side we are looking at the tissues and others. But we are also looking from our damage assessment side as to the impact that this may have on some of those species.

But I will take a step back and say, other species, some of the one we haven't tested, some of the deeper sea species and then also whether the dispersant would get to shore with oysters or some other creature, we may see some, we may be able to see some accumulation. But not necessarily biomagnifications in the higher order species.

Senator WHITEHOUSE. And you are comfortable that that is a viable indicator?

Mr. WESTERHOLM. I think that goes back to your statement earlier of how products are listed on the National Contingency Plan and whether this should be one of the criteria for approval process in the future of not having it bioaccumulative. Certainly we have seen in other regulator practices, and EPA can speak to this, is that certain chemicals that would bioaccumulated have not been allowed to be used in society. I think the same thing, we should have a series of more constructive tests to be able to more definitively prove that, and then use that as part of that follow-on approval process.

Senator WHITEHOUSE. To go back to what we do know about the dispersant that Chairman Boxer referred to, which has these characteristics of hazard to humans of liver damage, internal bleeding, and all those sorts of things, how does that transpire? What is the mechanism by which damage by Corexit gets done by humans sufficient to put it onto the hazard notice but isn't dangerous in any of the ways that you are describing? I am a little bit confused as to how it can be dangerous to humans sufficient to trigger notice but not dangerous with exposure.

Mr. WESTERHOLM. There are a couple of ways that could happen, and depending on the chemical it certainly could be an inhalation hazard to humans. It could be a skin contact to humans.

Senator WHITEHOUSE. So direct exposure?

Mr. WESTERHOLM. At a level that certain safety protocols would be enacted to make sure that you were wearing protective clothing or in a position not to be exposed in an aerial dispersant mode. So with that in mind—that acute toxicity and some of the impacts of that would be by direct exposure to humans in that regard and not necessarily passed through ingestion through the food chain.

So I am sure on the MSDSs, the safety data sheets that she was looking at, as the hazards of those chemicals, that was for exposure to humans of that particular product in whatever concentration would show that impact.

Senator WHITEHOUSE. And the reason that that acute toxicity is not showing up in your field studies is because the concentration that you are testing at is below the level that would cause it, or is it because the creatures you are testing are fundamentally or intrinsically more resilient than humans and don't suffer the same injury when exposed to the chemical?

Mr. ANASTAS. I would suggest that, for example, of the component that you are talking about in the Corexit, in determining a toxic effect, it is looking at all the possible ways that this could cause acute toxicity. So if something were ingested, if something were for instance consumed in high concentrations, then these types of effects may occur.

When we are talking about releasing these substances into the Gulf, we do have to keep in mind that in 1 square mile of the Gulf at depth, we are talking about a trillion gallons of water. So those are very low concentrations.

Now, the concentrations that the test species are exposed to are increasing concentrations until you do see the toxic effects. So they aren't being exposed to high concentrations. And the species are at juvenile life stage. So they are supposed to be at a life stage where they are more sensitive to pollutants.

Senator WHITEHOUSE. The second vote now has 7 minutes remaining. And with no one else here, I am starting to feel the pressure of that vote. So what I will do is—ah, here is Senator Carper. Perfect timing.

[Laughter.]

Senator WHITEHOUSE. I will go vote and come right back. And if you would chair the hearing for the two witnesses here. And then I think we can move on to the next panel if nobody else has come to ask questions.

Senator CARPER [presiding]. I ask unanimous consent to bring up for a vote our multi-pollutant legislation, our 3-P bill that has been awaiting action.

[Laughter.]

Senator CARPER. We will get this moved, and then we will break for lunch.

[Laughter.]

Senator CARPER. Again gentlemen, welcome. Good to see you. How is the hearing going for you so far?

[Laughter.]

Senator CARPER. First of all, thanks again for joining us, for your testimony. I want to ask—there is a woman behind us who is Committee staff who is a marine biologist. I was asking her to give me just a little bit of marine biology 101 with respect to these microbes out in the ocean that enjoy having lunch on oil spills. Just kind of talk about that, really in a basic, fundamental way.

How does it work? We have the oil coming out of the ocean floor and have these chemical dispersants that we apply to the oil. Explain to us what happens, without getting into a lot of detail chemically, but what happens? How do these microbes do their work? How long do they live after they consume the oil?

Just give us a little bit of a rundown on that. I just want to understand that better.

Mr. WESTERHOLM. I will start with that one. Again, when you are looking at the microbes, if you think of it sort of at that bacterial level, and if you think of the oil globule as a certain circumference, they would be surrounding that oil and they would eat their way in, they would multiply, much like bacteria do, to continue to feed off of that.

Now, maybe I should take a step back and say there is a lot of natural oil seeps in that area. Petroleum hydrocarbons have been there for some period of time. And it tends to have—these particular microbes tend to flourish naturally in that Gulf of Mexico area anyway. So they are present, and maybe that is why we are potentially seeing what the initial indication is, that there is an acceleration of biodegradation, maybe even more than was expected.

The fact that you put dispersants on oil in theory, in models, will break them into much smaller diameter globules, which allows a greater surface area for a larger number of microbes. So if you think of one big ball, you can get so many around. But if you split that into 100, you can get more microbes, and that process will go faster.

So to answer your question about biodegradation, it really then depends upon how large a piece of oil you started with before that is dissolved to the subset of where there is no more biodegradation that would occur. At that point, with nothing else to feed on, if the microbes don't find anything else to feed on they themselves die, or they would have to find something else. There is a life cycle that they have, too, and a multiplication that they have around the oil.

But we know that the subsurface injection of dispersants has put—as well as natural dispersant, even if there was no dispersants applied, natural dispersion probably occurred coming up through the water column with anywhere between 10 to 20 percent of the oil coming off the wellhead release in that mile rise. Again, it also depends on the residency time and how much that oil weathers through the water column and on the surface.

So unweathered oil provides a much better surface and will biodegrade faster—the microbes can eat it—than weathered oil, which gets to more like the tar balls and the asphalting process. So I guess I am evading the total question of how long it takes, but it really depends on the size.

Senator CARPER. Thank you for the explanation.

Did you want to add anything, Mr. Anastas?

Mr. ANASTAS. Yes, thank you, Senator. Because I think it is important to recognize that we as humans might think we are very clever. But we are actually stealing an idea that nature has been doing for billions of years. Dispersion and natural dispersants are something that are in the Gulf. What we are doing is basically mimicking nature, or using biomimicry in order to try and accomplish this, try to help out, try and make the process happen faster than it otherwise would have without the use of added dispersants.

Senator CARPER. So oil is dispersed in larger pieces of the oil are dispersed, being much smaller, the microbes have an easier opportunity to glom on and go to lunch on the oil.

Mr. ANASTAS. That is right.

Senator CARPER. And as the microbes consume what is there in the water, do they have a short life span? Do they live for days, weeks, months?

Mr. ANASTAS. I don't know the specific life span of particular microbes. But what we are talking about is, yes, they feed on these, and ideally, when they eat them and metabolize them they are producing carbon dioxide and water. That is the natural breakdown product of the oil when it is consumed and digested and metabolized.

Senator CARPER. All right. And when the microbes die, what happens? Do they go to the bottom; do they gather in the bottom of the ocean? What happens? The microbes die after eating all this oil. Who eats the microbes?

Mr. WESTERHOLM. I would add what Dr. Anastas just said, they break down the oil into component parts of carbon dioxide and others. So then you are left with organic material both with the microbe itself and what it excretes. So much like organic material falling to the bottom of the ocean, or suspended, depending on the particle size, that is what you are left with.

Senator CARPER. As it falls to the bottom of the ocean and gathers there, what kind of threat does it pose to the marine environment?

Mr. ANASTAS. If the microbes have consumed and metabolized the oil, there should be in that scenario no additional risk to the marine environment.

Senator CARPER. So when people ask me saying, what happened to all this oil, this huge amount of oil that came out of the bottom of the Gulf, and now it seems to be going away, some of it has evaporated?

Mr. ANASTAS. Correct.

Senator CARPER. Roughly what percent would you say has evaporated?

Mr. WESTERHOLM. Twenty-four percent, 25 percent.

Senator CARPER. And a good deal of it is being consumed by these microbes, and that—what percent would you say has been consumed by the microbes? As much as is being evaporated? Or more?

Mr. WESTERHOLM. Well, I think you have to put that in two categories, that that has already been consumed and that that will be consumed. That will be the oil that doesn't rise to the surface and some that actually does and that gets consumed as it goes into shoreline. But it could be as much as 50 percent of that which is dispersed and what was residual in the water column or on shorelines that are starting to be biodegraded over time.

Senator CARPER. So if that is correct that leaves us with the last 25 percent or so to worry about. Is that roughly right?

Mr. WESTERHOLM. And that last 25 percent is what has been collected through the riser pipe, what has been skimmed off or what has burned. So ultimately some of the products in the very—even the tar balls over time, many of those will be the residual ones that could last for much longer. But most of what is in the water column and what is going to shore will start to biodegrade.

Senator CARPER. Good. I am going to ask you a couple more questions before my colleagues come back and try to take this mic away from me.

[Laughter.]

Senator CARPER. I understand the EPA has been researching the effects of dispersants in a subsurface environment. What do the studies tell us, and more importantly, what do they not tell us in terms of the long-term consequences of using dispersants?

Mr. ANASTAS. What we are looking to do going forward is have a better, deeper understanding of the long-term transport, fate, and exposure of these dispersants. So that means while we have some knowledge of how these dispersants travel in the water column and the various currents. Specifically how long it will take, how they will be metabolized, what are the breakdown products, what exposures they will give to fish and wildlife as well as humans. Those are some of the long-term questions that we want to have answered as we are going forward.

Senator CARPER. Second question, what steps can the Federal Government take to ensure that the next generation of dispersants in the Gulf are greener and maybe even more environmentally friendly than the ones we are already using?

Mr. ANASTAS. Senator Carper, this is a key question. It is certainly a key question for dispersants. It is a key question for the chemicals that we use in our daily life generally. What we have currently is a situation where we often are focused on characterizing the chemicals that we use in ways that we try to understand whether they are going to cause a toxic effect to humans or the environment, if they are going to bioaccumulated and persist.

But what we have not invested in as a scientific community are the insights that are needed to design the next generation of substances. This area of so-called green chemistry is a scientific approach to understanding not only the basis of the hazard that these chemicals cause, but more importantly how you design them so that they are not going to cause problems in the future.

So applying the principles of green chemistry to dispersants is going to be essential. It is going to be essential in order to do this, to have scientists trained and understanding both the nature of the problems that these chemicals pose, but also the solution.

I have often been quoted as saying that the only reason to deeply understand a problem is to empower its solution. And what we are hoping to get with a deeper understanding of the concerns that we have for dispersants—or really all chemicals—are the insights to invest intellectually and with resources to pursue green chemistry so that the next generation of dispersants are more environmentally benign.

Senator CARPER. As this tragedy has unfolded, and we have dealt with it, and we are hearing encouraging reports in the news, with the ability to plug the leak and maybe to do so on a permanent basis, we now turn to cleaning up this mess and trying to make sure that the people who live in that part of our country and that part of our world, help them get back to their lives, what surprises—if you look back to some of the things that happened, what are some of the surprises that you have seen, particularly with the use of dispersants, but some of the surprises that you have seen with respect to the clean up portion here?

Mr. WESTERHOLM. I can certainly start. One of the things that we have done over the years, obviously, is plan and prepare for what we would consider worst case scenarios. Obviously, a well blowout of this magnitude over this length of time was always possible, but never really figured that we would have one for this duration and have those issues. So we were really combating a major oil spill every day for as many days as that happened.

I think that was the first surprise. The second piece of that obviously was it was 50 miles offshore, depending on where you went off from the shoreline. That created some logistical challenges for just the ability to respond and the equipment that went out there.

I think that the idea of using subsea dispersants as opposed to surface, the first application was obviously surface, but it is not an unknown idea. There were some papers that were talked about earlier. But really it was not—it was technically challenging and unfeasible. But they came up with an innovative approach to do that for this time. So it was, I don't want to say, maybe surprise is the wrong word, but it certainly had to put a lot of people in the position of making quick decisions and alert decisions.

Then in addition, from an environmental point of view, both EPA and ourselves had to come up with a monitoring strategy that had never been in place. For years, the SMART protocol I mentioned earlier was used for dispersants, which basically looked at how effective they were in the water column and where we expected them to go, which was surface dispersants pushing them down to maybe as much as 30 feet, maybe more like 10 feet into the water column. Here we were dealing with something a mile below the surface.

So we really came up with a toxicity test with rotifers and a dissolved oxygen test to show not only efficiency but also effectiveness.

Senator CARPER. Thank you for that response. Thank you for all your responses and your testimony here.

Mr. Chairman, I have only had 13 minutes, and that is not enough. But I will grudgingly yield back my time.

Senator WHITEHOUSE [presiding]. Well, these two witnesses have been very helpful and very informative and also been subjected to longer periods of questioning than most, because we have had these circumstances in which so many colleagues are over at the vote. But I think at this stage it would be appropriate to thank them both for their testimony, excuse this panel, and call up the second panel of witnesses. We will take a 2-minute recess for the chair change.

Thank you both very much.

[Recess.]

Senator WHITEHOUSE. All right, the hearing will come back to order.

I thank the witnesses for being here. Our first witness is Dr. Ronald J. Kendall. He is the Director of the Institute of Environmental and Human Health and Professor and Chairman of the Department of Environmental Toxicology at Texas Tech University. And if you think it is easy to say Toxicology at Texas Tech fast, it isn't.

His research is focused primarily on ecotoxicology, wildlife toxicology, and risk assessment. He is most welcome as a witness here.

Thank you for your testimony, Dr. Kendall. Please proceed.

STATEMENT OF RONALD J. KENDALL, PH.D., DIRECTOR, THE INSTITUTE OF ENVIRONMENTAL AND HUMAN HEALTH, AND PROFESSOR AND CHAIRMAN, DEPARTMENT OF ENVIRONMENTAL TOXICOLOGY, TEXAS TECH UNIVERSITY

Mr. KENDALL. Thank you, Chairman Whitehouse. It is a pleasure to be here today.

We have already heard earlier today of estimates of more than 200 million gallons of crude oil being released into the Gulf of Mexico as a result of the Deepwater Horizon incident. In addition, we have heard an estimated 1.8 million gallons of dispersant were used in the Gulf, and particularly in the deep water. And this is unprecedented.

Corexit 9500 has been the predominant dispersant used. Though the application of the dispersant may very well have protected shorelines and parts of the Gulf Coast ecosystem, there is still an immense area in the Gulf that is under stress and potentially impacted from the heavy use of these dispersants. In essence, my colleagues and I who have been studying this situation believe that a massive ecotoxicological experiment is underway.

We have very limited information on the environmental fate and transport of the mixture of dispersant and oil, particularly in the deep ocean. We have very little information on the ecological effects of this particular oil and dispersant mixture in terms of acute, chronic, and indirect effects to marine and coastal organisms.

Given the volume of oil and dispersant that has been released into the Gulf, we have a very poor understanding of the ultimate ecosystem effects. So when we bring this all together, we have a very challenging situation, of course, in dealing with a massive oil spill. Yet at the same time did we really understand the environmental toxicology of such a massive use in the deep water of a substance such as Corexit 9500? And I say we did not.

As we looked at the environmental chemistry of the deep water use of the dispersant-oil mixtures, crude oil is a mixture of thousands of chemical compounds, including aromatic hydrocarbons and polycyclic aromatic hydrocarbons. We believe—and it appears to be upheld with more recent research—that the use of dispersants creates the release of these toxins into the water column, and in fact the use of Corexit 9500 does put more hydrocarbons into the water column. That is essentially what we are seeing.

Crude oil can have physical, toxic, and indirect effects. We have seen much evidence of oil on birds and other wildlife, and of course that is terrible. But in addition the use of dispersants basically disperses the oil into the water column, and the toxic components of oil are available to exposed organisms. These dispersants, as we have heard in earlier testimony, are not totally non-toxic. They have toxic qualities. But it is the dispersant-oil mixture and ultimate release of toxins into the water column that we believe could be of a concern in the ecological perspective.

Let's just consider some species. We have talked a lot of theory already today. But let's consider the Gulf of Mexico and the many endangered species that live there. Take the Kemp's ridley sea turtle, one of the most endangered species of sea turtles in the world. Many of them nest on the coast of Texas. And the hatchlings are returning to the Gulf now. They are only about 1° inches long when they return, by the thousands, to the Gulf. They go to the open Gulf and exist for years, moving in the currents, perhaps co-locating with sargassum, a seaweed. They feed opportunistically.

And it may take many years before they may return to Texas to lay eggs. Therefore, if we affect their food chain or affect those hatchlings we may not see this for years to come. And we do know they can be susceptible to oil.

Take the sperm whale. They are endangered. The females come to the Gulf to calve in the summer. They feed opportunistically in the deep water on squid, cephalopods. We have no idea what the deep water injection of dispersants could have done to release oil into the water column and impact such food supplies for endangered species. So these are questions that we may not have the answers revealed to us for years to come.

The bluefin tuna—perhaps moving to threatened status itself—they come to the Gulf and spawn. The eggs float in the Gulf; they hatch. The larva then feed opportunistically on zooplankton. They co-locate with sargassum as well. If we impact the sargassum or impact the zooplankton we could take out portions of age classes of the bluefin tuna. And again, we may not see this for years to come.

So again, we are conducting a massive ecotoxicological experiment, and we need research and scientific data that can be peer reviewed and brought to the table to make good decisions for the future.

I might add that dispersants are a tool. But they need to be fully researched, and we need to have the environmental toxicology data on them to truly apply them in the best environmental stewardship possible.

Thank you.

[The prepared statement of Mr. Kendall follows:]

"Oversight Hearing on the Use of Oil Dispersants in the Deepwater Horizon Oil Spill"
United States Senate
Committee on Environment and Public Works
August 4, 2010

Testimony by Ronald J. Kendall, Ph.D.
Director, The Institute of Environmental and Human Health (TIEHH)
Professor and Chairman, Department of Environmental Toxicology
Texas Tech University
Lubbock, TX

Chairman Boxer and members of the Committee: I am Ronald J. Kendall, Director of The Institute of Environmental and Human Health (TIEHH), and Professor and Chairman of the Department of Environmental Toxicology at Texas Tech University. I have been engaged in research, along with my colleagues, on the science of the Deepwater Horizon Oil Spill (DHOS).

I appreciate the opportunity to appear before the Committee today to testify on the use of oil dispersants in the Gulf. Before I begin my remarks, I would like to extend my most sincere condolences to the families of those individuals who lost their lives at the outset of the Deepwater Horizon incident, and to all Americans whose lives have, or will be negatively impacted by this event.

As of early August 2010, the DHOS has resulted in the release of an estimated high end volume of over 180 million gallons of crude oil into the Gulf of Mexico. A total volume of 1,843,786 gallons of dispersant has been used in the Gulf since the oil leak began on April 20, 2010 (http://www.deepwaterhorizonresponse.com/go/doctype/2931/53339/). Approximately 42% of that total has been applied at the leaking wellhead located between 4,000-5,000 feet below the surface. Application of dispersant at these depths is unprecedented. Corexit 9500 has been the predominant dispersant used. Though application of dispersant at the wellhead may indeed have limited damage to some components of the Gulf of Mexico ecosystem (beaches, wetlands, etc.), it is unknown how, where, or to what extent the oil-dispersant mixtures will alter overall ecosystem structure and/or function. I will testify before you today as to why my colleagues and I believe that the DHOS represents an ongoing ecotoxicological experiment that is being conducted on a massive scale. These reasons are as follows:

1. We have very limited information on the environmental fate and transport of the mixture of dispersant and oil, particularly in the deep ocean.

2. We have very little information on the ecological effects of this particular oil and dispersant mixture in terms of acute, chronic, and indirect effects on marine and coastal organisms.

3. Given the volume of oil and dispersant that has been released into the Gulf of Mexico, we have a very poor understanding of ultimate ecosystem level effects which may occur in the weeks to months to years ahead.

These issues warrant serious concern among environmental toxicologists such as myself and many of my colleagues across the nation that are considering this event from an ecotoxicological perspective (Kendall *et al.*, 2010). Perhaps most disconcerting is the uncertainty of how dispersant-oil mixtures may influence the ecology of the Gulf. When considered holistically, the Gulf ecosystem spanning the deep ocean, continental shelf, bays, estuaries, and marshlands is extraordinarily interconnected and complex. It is too soon, and there are insufficient data available to begin to predict outcomes. There is an urgent need for independent, peer-reviewed research that will help us understand the ramifications of using dispersants en masse, and at the bottom of the Gulf. The scientific community must engage this issue with an unbiased, science-based approach.

My testimony today, August 4, 2010, will draw upon current research efforts conducted by myself and colleagues at TIEHH in both the field and laboratory to evaluate the response of wildlife to oil, dispersant, and mixtures wherein dispersant is applied to the oil. I will also draw upon 40 years of experience in conducting field and laboratory research on the effects of environmental contaminants on wildlife resources, and our most recent book "Wildlife Toxicology: Emerging Contaminant and Biodiversity Issues" published May, 2010, by CRC Press.

Environmental Chemistry of the Mixture of Deepwater Horizon Oil and Dispersant

Oil spill dispersants are used to facilitate the physical mixing of crude oil with water. The interaction of dispersants with crude oil alters the chemical and physical properties of the oil and thus changes how the oil behaves in the environment. Such changes can determine the likelihood that marine organisms will be exposed to the various components of crude oil. The use of dispersants in no way reduces the amount of oil entering the environment, but does reduce the potential for slicks of oil to wash ashore and contaminate shoreline and coastal wetland habitats. Thus in theory, dispersant use limits the exposure of animals such as birds and marine mammals that may exist near the water surface or shoreline to the components of crude oil. However, it is recognized (and accepted once the decision is made) that dispersant use increases exposure potential for water-column and benthic organisms.

Crude oil is a complex mixture of thousands of chemical compounds; however, the aromatic hydrocarbons (both simple and polycyclic) are considered the most toxicologically important. Simple aromatics (benzene, toluene, xylenes) are volatile and are rapidly lost from the oil in most instances. It is not clear what impact the depth of the well and the use of dispersants at depth might have on the fate of the volatile components in the oil. Although oil from the DHOS is reported to have lower concentrations of petrogenic polycyclic aromatic hydrocarbons (PAHs) compared to crude oil from other sources (NOAA, 2010), burning of the oil is likely to produce significant concentrations of pyrogenic PAHs. It is well established that multi-ring PAHs are carcinogenic and important toxicologically from a chronic exposure standpoint.

There are uncertainties with regard to the environmental fate and transport of oil to which dispersant has been applied at depth. What happens to the volatile components in crude oil when dispersants are applied at such depths? What is the impact of dispersant on the mobility of oil? How is the mobility of dispersed oil affected by weather events such as tropical storms? Does dispersed oil biodegrade faster or slower than non-dispersed oil at these depths? Is there a greater oxygen demand created by the degradation of dispersed oil? Is dispersed oil more susceptible to abiotic process such as photodegradation or photoactivation?

Toxic Effects of Deepwater Horizon Oil and Dispersant

Crude oil can have physical, toxic, and indirect (e.g. food web-related) effects on fish and wildlife. The physical effects of crude oil exposure most often result in the loss of thermoregulation from the oiling of feathers or fur, but may also result in suffocation, and starvation. Toxic effects from crude oil exposure can arise from direct ingestion of the oil, inhalation of volatile components of the crude, or uptake of the water accommodated (soluble) fraction (WAF) of crude oil across exposed membranes. The use of oil dispersants enhances the likelihood of exposure and subsequent effects by producing smaller droplets of oil that could be mistaken as food, by increasing the amount of the water accommodated fraction (CEWAF, or chemically enhanced WAF) of crude oil, and by exposing aquatic organisms to the dispersant itself.

As previously stated, Corexit 9500 has been the dispersant most widely used in response to the DHOS. The U.S. EPA's National Health and Environmental Effects Laboratory recently reported that Corexit 9500 could be characterized as "slightly toxic" to Mysid shrimp (*Americamysis bahia*: 48hr LC50 of 42 ppm), and "practically non-toxic" to the inland silverside (*Menidia beryllina*: 96hr LC50 of 130 ppm; Hemmer *et al.*, 2010). Among eight different dispersant formulations evaluated, four were less toxic to shrimp, but only one other dispersant was less toxic to the silverside. Though other National Contingency Plan-listed dispersant formulations may be less toxic than Corexit 9500, none are dramatically safer according to limited research directly comparing dispersants under similar protocols and conditions. EPA has concluded that "all of the dispersants are roughly equal in toxicity and generally less toxic than oil."

Recent efforts by EPA to characterize dispersant toxicity to marine organisms represent a step in the right direction in the development of a weight-of-evidence approach to assessing the impact of dispersant use. However, critical data gaps exist with respect to the potential impacts of dispersant use and the fate, transport, and effects of dispersed oil. The data gaps exist partially because of a lack of information on the toxicological interactions of crude oil and dispersants in general, and partially because of the unprecedented use of dispersants at depth in the DHOS specifically. While some aquatic toxicity data are available for various crude oil and dispersant combinations (NRC, 2005), additional data are needed from site-specific toxicity tests on crude oil emanating from the DHOS.

The combination of dispersant and oil in aqueous mixtures appears to be of greater risk to aquatic organisms than dispersant or oil alone. Dispersants enhance the availability of the crude oil and therefore potentially increase uptake of crude oil components into marine organisms. Dispersants also promote formation of micelles or oil droplets within aqueous matrices. A large majority of studies that seek to compare toxicity of oil alone versus dispersed oil demonstrate that dispersant-aided changes in crude oil solubility enhance exposure and toxicity among aquatic organisms.

It should be noted that nearly all research conducted on the chemical fate, transport, and toxicity of dispersants and dispersant-oil mixtures has been performed in settings and under conditions vastly different than those that exist deep in the Gulf where much of the dispersants have been applied. Extreme pressure, low temperatures and light, and reduced oxygen concentrations can dramatically alter physical, chemical, and biological processes. Further, extrapolation of toxicity data from a limited number of species indigenous to the Gulf may not provide sufficient information on the sensitivity of a broad array of ocean-dwelling organisms, particularly those that occupy deepwater niches.

Potential Gulf of Mexico Ecosystem Effects from Deepwater Horizon Oil Release and Use of Dispersants

All of us recognize that the Gulf of Mexico is an extremely important resource for the United States of America for many reasons including its natural beauty and wildlife, seafood and commercial fishing industry, tourism, and energy production, particularly oil. Although natural disturbances such as hurricanes can have substantial impact on the Gulf environment, these natural events come and go and are part of the way of life in the Gulf of Mexico. However, the DHOS is now the largest oil spill in American history, and the decision was made to add to that enormous volume of oil an unprecedented volume of dispersant. In toxicology, it is broadly accepted that "the dose makes the poison". Therefore, we have significant potential for toxicity among Gulf organisms which may manifest as ecosystem level impacts as we move into the future. Why consider this at the ecosystem level? Take for instance the Kemp's ridley sea turtle (*Lepidochelys kempii*), an endangered species for which extensive recovery efforts have been made. Many female Kemp's ridleys nest along the coast of Texas before returning to the Gulf (Seney and Landry, 2008). They then head to feeding grounds, often off Louisiana or the west coast of Florida. The Kemp's ridley sea turtle utilizes the Gulf of Mexico ecosystem throughout its life cycle (Shaver *et al.*, 2005). To date, we have seen hundreds of dead turtles reported in the last several months (since April 2010). Kemp's ridley sea turtles are highly susceptible to anthropogenic stressors like oil spills which may cause mortality or disrupt normal behaviors. When Kemp's ridley eggs hatch, the young, which may be only about 1.5 inches long, return to the ocean where they will leave the near shore environment and enter an open ocean developmental stage; moving with Gulf currents, feeding predominantly on jellyfish, fish and crabs (Schmid and Witzell, 1997). It is thought that young turtles at sea may associate with *Sargassum* (floating seaweed) for refuge, rest and/or food. Oil-dispersant impacts on seaweed could result in serious negative impacts among young turtles. If oil affects the food supply of the Kemp's ridley or disturbs critical stages of its life cycle, we may not see oiled, dead Kemp's ridleys, but their population abundance could be imperiled by subtle indirect effects of dispersed oil on the environment.

Another example is the sperm whale (*Physeter macrocephalus*), also an endangered species. Sperm whales are the largest of the toothed whales, and they hunt relatively larger bodied prey (e.g. squid) in deep water. Dispersant-oil mixtures suspended in the water column, particularly in deep water, could be toxic to both adult and juvenile sperm whales, (Knap *et al.*, 2002). Sperm whales are in the Gulf of Mexico during the summer which is also an important calving period (Blaylock *et al.*, 1995). Young animals are often more susceptible to environmental contaminants than adults. This increases concern for juvenile sperm whales. In an ecosystem context, these whales feed heavily on cephalopods (particularly squid) and disruption of the food chain could be of considerable detriment to adults caring for young. Moreover, whales may be forced to abandon critical calving or feeding grounds due to the presence of suspended oil-dispersant mixtures. Therefore, we could potentially see both direct and indirect effects from the DHOS as a result of dispersed oil and associated toxic constituents in areas where sperm whales are known to occur in the Gulf of Mexico (Godard *et al.*, 2004).

As a final example, the western Atlantic population of bluefin tuna (*Thunnus thynnus*) has experienced a tremendous decline over the last few decades. The DHOS may present additional negative impacts to this marine resource because primary spawning areas are located within the Gulf. The eastern Gulf spawning area is within the general vicinity of the well and potential plumes of dispersed oil (Teo and Brock, 2010). In the Gulf of Mexico, bluefin tuna catch per unit effort peaks in April, suggesting that the majority of spawning occurs during the March to May time frame. Thus, larval bluefin most likely occupy Gulf waters from the peak spawning times onward through the summer, suggesting a temporal overlap with the presence of dispersed oil, oil plumes, and oil sheen in the Gulf of Mexico. Bluefin tuna spawn in the open waters of the Gulf of Mexico, and larval tuna generally utilize surface layers of the Gulf. Larvae are carried by currents and accumulate in convergence zones. Pelagic *Sargassum* seaweed also accumulates in these zones and provides important habitat for larval fish (Comyns *et al.*, 2002). It is likely that oil on the surface of the Gulf also accumulates in these areas and the potential exists for interactions between oil and *Sargassum* habitat that may ultimately influence larval bluefin tuna. One current unanswered question is whether oil (tar balls and/or dispersed) may bind or physically associate with *Sargassum*, increasing the risk of toxicity to larval bluefin tuna and other pelagic species.

In other habitats, the diet of larval tuna includes crustaceans prior to shifting to a fish based diet (Llopiz *et al.*, 2010). Potential toxicity due to Corexit 9500 and dispersant-oil mixtures in the Gulf of Mexico may influence zooplankton and other crustaceans. The LC50 of Corexit 9500 has been reported to be 21 and 5.2 ppm for brine shrimp (*Artemia salina*) and copepods (*Eurytemora affinis*), respectively (George-Ares and Clark, 2000). Thus a potential for indirect effects of dispersants on bluefin tuna include reduced abundance of food resources. In addition, toxicity resulting from dispersed oil well below the surface could feasibly impact zooplankton and other crustaceans important to larval bluefin tuna due to their vertical water column migrations. Further, the direct toxic effects of Corexit 9500 on larval pelagic fish species such as bluefin tuna are relatively unknown.

Like everyone else, I received news that the well has been capped with great relief and guarded optimism. In the days since the flow of oil into the Gulf has stopped, many have begun to ask the question, "Where is the balance of the oil that leaked out?" I believe that the extensive use of dispersant has resulted in much of the oil released from the Deepwater Horizon site to remain suspended in the Gulf, dispersed in the water column.

A simple estimate drawn on experience gained during the Exxon Valdez oil spill of 1989 can be used to illustrate. There, approximately 11 million gallons of oil was released into Prince William Sound resulting in oiling of over 1,000 miles of shoreline. In the present oil spill, which is upwards of 20 times greater in volume than the Exxon Valdez spill, we have only seen 600 miles of oiled shoreline. Therefore, it may be surmised that, aside from volatilization, burning, and other remedial efforts, much of the oil remains at sea.

I appreciate the opportunity to testify today. This hearing will encourage the scientific community to generate much needed data related to use of dispersants in response to the DHOS. Again, I believe there is an urgent need for independent, applied research to fill data gaps on the potential impacts of dispersed oil on gulf wildlife. Hopefully, information generated in future studies will aid in the assessment of effects, identification of effective remedial strategies, and with the restoration and preservation of the Gulf Coast ecosystem.

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United States Senate Environment and Public Works Committee Hearing
August 4, 2010
Follow-Up Questions for Written Submission
Addressed by

Ronald J. Kendall, Ph.D.
Director, The Institute of Environmental and Human Health (TIEHH)
Professor and Chair, Department of Environmental Toxicology
Texas Tech University

Questions from:

Senator Barbara Boxer

1. Professor Kendall, your testimony states that "dispersants enhance the availability of the crude oil and therefore potentially increase the uptake of crude oil components into marine organisms."

Could you please go into this point in greater detail and explain how this process might work, as well as the types of research that has or could be conducted to study this effect?

Kendall Response

Crude oil such as what was released from the Deepwater Horizon event in the Gulf of Mexico would typically float unless dispersed. The dispersion strategy principally involved the introduction of Corexit 9500 into the oil stream exiting the damaged well as well as the surface application of dispersants to oil slicks via airplanes. Dispersants do not change the volume of oil but rather change the droplet size into smaller droplets in addition to facilitating the suspension of oil droplets into the water column versus on the surface. This fact was scientifically proven by recent data from the United States Environmental Protection Agency, which showed that dispersants interacting with crude oil increased hydrocarbon loading in the water column (Judson et al 2010). In addition, other scientific evidence from Woods Hole Oceanographic Institute indicated the presence of "oil plumes," one of which was more than 22 miles long in the subsurface of the Gulf of Mexico (Camilli et al 2010). Such a large subsurface plume appears to have resulted from the heavy use of dispersants at probably the wellhead in the Deepwater Horizon event.

Oil is a complex mixture of thousands of compounds. Some of the classes of compounds that exist in oil can be hazardous to marine life. For instance, aromatic hydrocarbons such as benzene, toluene, and kerosene all represent toxicologically important compounds that could be released into the water column subsequent to heavy dispersant introduction into an oil stream. Another class of compounds that exists in oil is polycyclic aromatic hydrocarbons, which can be carcinogenic such as benzo[a]pyrene. Again, the heavy dispersion of oil could facilitate the release of polycyclic aromatic hydrocarbons that may expose marine organisms. It appears that the heavy use of dispersants in the subsurface of the Gulf of Mexico probably creating "oil plumes" may have also increased the bioavailability of oil to microorganisms. Recent evidence from Lawrence Livermore National Laboratory suggests that deep sea marine bacteria appeared to be degrading hydrocarbons; however, this study is unique and for the first time reports such evidence from the deep sea, but is yet to be replicated and/or validated by others (Hazen et al 2010).

Research is needed to understand how dispersants affect crude oil and particularly the toxic constituents of crude oil. There is need for research to understand these processes in near shore waters as well as the deep sea. To date, we have extremely limited environmental toxicology information on dispersants to the point that we can hardly conduct a basic ecological risk assessment with these materials for their "approval" for use.

2. Professor Kendall, you make the point that nearly all research on the movement and toxicity of dispersants and dispersant-oil mixtures has been performed under vastly different conditions than exist in the deep gulf.

Could you describe the environment in the deep gulf and summarize how these conditions might impact the longevity and movement of these substances throughout the gulf?

Kendall Response

I am an environmental toxicologist who studies the impacts of toxic substances on fish and wildlife resources (Kendall et al 2010). Other scientists, such as those at Woods Hole Oceanographic Institute, have spent careers investigating the deepwater environment of our oceans, such as the Gulf of Mexico. They will support the idea that we know very little about the ecology of deepwater environments such as the Gulf of Mexico. Therefore, my answers are qualified by this perspective. However, in general, from 2500 feet deep to 5000 feet deep in the Gulf of Mexico, this is an area vastly different than a laboratory experiment to look at the response of organisms to oil and dispersant mixtures. For instance, the deep gulf is a dark and cold environment. In addition, there is relatively less oxygen than in surface environments, and as a result, the capability for aerobic metabolism of oil is reduced. With respect to movement, currents that could move oil plumes, particularly dispersed oil, do exist in deep water.

Generally, we would look at these environments as being slower in degrading organic material (similar to why we store our food in a refrigerator to reduce bacterial contamination and spoiling). As pieces of scientific information continue to be published in the peer-reviewed literature, I believe we will know better the potential dispersion of oil in the deep water and, perhaps, better understand its environmental toxicology.

3. Professor Kendall, your testimony describes potential direct and indirect effects on various species in the gulf from the use of dispersants, which may occur if an oil-dispersant mixture is suspended in the gulf's water column.

What types of toxicity or other tests do you believe should be conducted to better understand the potential impacts from using dispersants on the gulf's marine ecosystem?

Kendall Response

We have such an extremely limited amount of information on dispersants and their environmental toxicology and it is actually very difficult to even assess ecological risk at this time without enormous speculation. Scientifically, I view the dispersants as very similar to the use of pesticides. Pesticides are used to control pests and, in fact, kill them. In the Deepwater Horizon Gulf oil spill, we were told that the number one enemy was oil (i.e. "the pest"), and we were going to kill that enemy utilizing various tools, including dispersants. Now, for a pesticide to be registered for use, a number of standardized tests are conducted in both the laboratory and field that allows scientists and regulatory authorities the ability to better understand ecological risk and, particularly, to describe relative environmental toxicological risk in order to select the best pesticide possible for engagement of the pest they are to control in various environments. I believe the same process should be implemented with dispersants. They should be tested thoroughly in the field and laboratory on appropriate species to look at environmental toxicology. In addition, the environmental chemistry should be better understood related to action on oil, residence time in various environmental compartments, and inherent toxicity. We already have a model to do this for the pesticide industry through the Federal Insecticide Fungicide and Rodenticide Act. Perhaps we need a Dispersant Chemical Control Act.

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Texas Tech University

Questions from:

Senator Bernard Sanders

1. You characterize the use of dispersants in the Deepwater Horizon oil spill as an "ongoing ecotoxicological experiment that is being conducted on a massive scale." Can you briefly give us an approximation of a worst case scenario for this experiment and an approximation of a best case scenario (e.g., effects on human health, effects on other organisms)?

Kendall Response

Briefly, a worst case scenario could build upon my written U.S. Senate testimony that described sentinel species that may be utilized to provide evidence on the gravity of impact of this oil spill in the Gulf of Mexico and the heavy use of dispersants. First of all, what if we decimated the Summer 2010 age class of endangered sea turtles, which were returning to the Gulf from this year's nesting cycle? Effects could be direct in terms of toxicity of the oil to hatchling sea turtles or indirect by affecting critical marine habitats including Sargassum seaweed. Another example would be the impact on the 2010 age class of bluefin tuna. After spawning in the Gulf, the bluefin tuna larvae feed opportunistically on zooplankton and may utilize Sargassum habitats. In general, juvenile fish are much more susceptible to toxic substances such as oil and oil dispersant mixtures than adult life stages. Therefore, bluefin tuna larvae, in encountering oil and/or oil dispersant mixtures, could be seriously impacted. In addition, effects could be directly toxic to larvae or to their food supply, zooplankton, or important habitats they will co-locate in, such as Sargassum. Let's take another example including the sperm whale. Calving occurs in the gulf during the summer and in the vicinity of the Deepwater Horizon oil release. Their food supply, particularly for the adults, is cephalopods or squid, in the deep sea. Effects could exist for direct toxicity of oil and/or oil dispersant mixtures, particularly to sperm whale calves or to the food supply, squids. In general, immature mammals are much more sensitive to the exposure of toxic substances than adults. That is the reason we have so much more extensive protection of children for toxic exposure than adults. In other words, the immune system and the ability to metabolize toxic substances are not as developed in the young, as would probably be the case with sperm whale calves.

With just these three sentinels, endangered turtles, bluefin tuna, and endangered sperm whales, the removal of a single age class could have significant population-level effects in the future. Unfortunately, there is a good chance that if we waited to see these effects, it could be too late for recovery. We know this from population ecology studies of wildlife.

In terms of worst case scenarios related to human health, I would be particularly concerned with workers that were handling oil in clean-up operations and that received sustained exposure to the outgassing of particularly aromatic hydrocarbons from oil. Benzene as an aromatic hydrocarbon in oil is a carcinogen. Other aromatic components in oil can cause toxicity to the nervous system, liver, kidney, and other organ systems. The worst case scenario could be an increase of cancer, particularly in exposed workers, as well as other neuropathy problems, some of which may be delayed. We already know many workers were sent to the hospital after exposure to surface oil.

The best case scenario would be that the dispersion of oil in the deep water was the correct thing to do and enhanced bioavailability to microorganisms for degradation. In addition, the current kills statistics for birds, turtles, and marine mammals will not elevate greatly from what exists in September 2010. In addition, we will see no evidence of negative effects in the years to come on certain sentinel species, such as endangered turtles, bluefin tuna, and endangered sperm whales. In other words, their populations will remain stable and/or increase in size. We will also see a resurgence in bird populations that have been heavily impacted, such as in Louisiana, and we will not see a re-listing of the brown pelican to threatened status.

Another best case scenario will be that we will have no measurable long-term impacts to humans exposed to the oil, particularly clean-up operations and workers handling oil on a daily basis.

2. The combination of dispersant and oil appears to be of greater risk to aquatic organisms than dispersant or oil alone. What research are your institutions conducting relevant to the toxicity of the dispersant-oil combination, or can you discuss any prior research about the effects of this combination?

Kendall Response

Currently, we have extremely limited information on the environmental toxicology on the dispersant/oil mixture, as well as the dispersant alone to aquatic organisms. To gain a better understanding of these questions The Institute of Environmental and Human Health (TIEHH) at Texas Tech University is engaging a variety of studies. It is important to note that we are funding our own research. Those studies include the following:

1. Fish studies to look at the toxicity of dispersant and dispersant/oil mixtures.
2. Amphibian studies to look at the toxicity of dispersant and dispersant/oil mixtures.
3. Avian embryo studies to look at the effect of weathered crude, dispersant and dispersant/oil mixtures.
4. Turtle studies to look at the toxicity of dispersant and dispersant/oil mixtures.
5. Crab studies to look at the toxicity and bioaccumulation of dispersant and dispersant/oil mixtures.

I am confident that research is underway at other institutions on dispersant and dispersant oil mixtures but I am not aware of specifics at this point. I do know that National Public Radio contacted me June 11, 2010, indicating that a number of scientists were trying to obtain dispersants from the manufacturers but were unable to obtain them. I subsequently was asked to do a National Public Radio show on this subject (NPR 2010) and soon after that the dispersant was released to the scientific community. That is why I believe that a lot of academic research is probably underway on this subject.

The United States Environmental Protection Agency produced a scientific paper (Judson et al 2010) on the toxicity of dispersant and dispersant oil mixtures to two species including mysid shrimp and inland silverside fish. From this study, it did not appear that the oil dispersant mixture was more toxic than oil or dispersant alone. However, this is just one study in a laboratory environment. We need many studies under a variety of conditions and on a spectrum of organisms that represent different ecological roles or contribute to different ecosystem functions. This can only be accomplished in the most rigorous scientific way with research funds specifically allocated toward this objective.

United States Senate Environment and Public Works Committee Hearing
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Follow-Up Questions for Written Submission
Addressed by
Ronald J. Kendall, Ph.D.
Director, The Institute of Environmental and Human Health (TIEHH)
Professor and Chair, Department of Environmental Toxicology
Texas Tech University

Questions from:

Senator James M. Inhofe

1. You mention in your testimony, the need for site-specific toxicity tests. How would such site-specific toxicity tests be conducted? Are there broad categories of oil types or ecosystems that would help categorize toxicity testing?

Kendall Response

With the heavy use of dispersants in the Deepwater Horizon oil spill, we observed many different oil types in multiple environments in the Gulf of Mexico during the Summer of 2010. For instance, surface crude oil did approach the shore and intertidal marsh area, particularly in Louisiana. In addition, expansive oil sheen was seen on the gulf along with floating mats, often interspersed in sheens of oil that appeared "mousse-like" and were very thick, sticky, and heavy. In addition, subsurface oil was seen approaching the shoreline along with tar balls. It has now been revealed that deep sea "oil plumes" have been discovered and tied back to the Deepwater Horizon oil spill. Therefore, a suite of site-specific toxicity tests are needed to assess potential ecotoxicological effects in the intertidal zone, coastal marsh and estuary of the Mississippi River entering the Gulf, near shore and habitats offshore as well as deepwater environments. Some of these tests could involve field sampling for exposed organisms including vertebrates and invertebrates in order that exposure may be assessed and biomarkers of effect be identified, such as induction of liver enzymes. In the laboratory using both oil and oil dispersant mixtures, toxicology studies are being implemented to assess multiple organism exposure representative of species in the Gulf in terms of dose response experiments as well as validating biomarkers of exposure and effect. Models for conducting integrated field and laboratory studies have already been developed for pesticides and could well be adapted to oil and oil dispersant mixtures in both the field and laboratory.

Yes, there are broad categories of oil types and the release from Deepwater Horizon was similar to south Louisiana crude, which is a lighter oil containing less sulfur and generally noted to have lower concentrations of polycyclic aromatic hydrocarbons. Therefore, the toxicological tests could be developed to particularly examine aromatic hydrocarbon exposure such as benzene to aquatic organisms as well as dose response with polycyclic aromatic hydrocarbons. Again, there are excellent models to conduct ecotoxicological tests based on the environmental chemistry of a substance of interest, such as a pesticide, and this could be adapted to strategies and technologies to assess dispersant and oil dispersant mixtures since dispersants were so heavily used in the Deepwater Horizon event.

2. Is there any way to distinguish between effects of oil and the effects of dispersants?

Kendall Response

Yes, this would initially require well-designed laboratory toxicological tests and the analysis techniques for examining interactions may be complex. Understanding the individual effects and the effects of the combination of dispersant and oil is challenging because essentially a combination of two complex mixtures is created. I believe the appropriate approach for understanding the combination is to examine each main effect (i.e., dispersant and oil alone) and the interaction effect on a toxic response. The observed response for the interaction can then be compared to predicted responses for the mixture based on different mixture models. These models are usually driven by whether mixture constituents have similar or dissimilar mechanism of toxic action. In the case of the oil/dispersant mixture, there is likely a combination of both. It would also be helpful to conduct experiments such that exposure to oil and oil/dispersant mixtures occur across a range of concentrations because interaction patterns between dispersant constituents may vary across a concentration gradient. From these laboratory-based mixture studies, biomarkers of exposure and biomarkers of effect could be evaluated and validated to support future field-based research.

I should also add that the ingredients in the dispersant, Corexit 9500, were not revealed to the scientific community until just a few months ago. Therefore, there has been little time to generate the data necessary to fully answer this question, although theoretical strategy for getting an answer to this very reasonable question is in place.

The bottom line is that developing an understanding of the environmental consequences of dispersant/oil mixtures is complex and resource intensive. However, it is achievable with a dedicated source of funds to address this specific problem. Unfortunately, if more research on this topic is not conducted, we may never know the environmental consequences of the use of oil dispersants.

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Senator WHITEHOUSE. Thank you, Dr. Kendall. That was very helpful.

Our next witness is Dr. David C. Smith of the Graduate School of Oceanography from my home State's University of Rhode Island. It is one of the jewels in the crown of our university system. We are delighted that David could be here.

Welcome, Dr. Smith.

STATEMENT OF DAVID C. SMITH, PH.D., PROFESSOR AND ASSOCIATE DEAN, GRADUATE SCHOOL OF OCEANOGRAPHY, UNIVERSITY OF RHODE ISLAND

Mr. SMITH. Thank you, Senator. Good morning.

I am David Smith, Professor and Associate Dean at the Graduate School of Oceanography. I appreciate the opportunity to testify on this very important subject.

The environmental trade-offs associated with the use of dispersants in response to oil spills are difficult to assess, and therefore their use remains controversial. Dispersants reduce the chance oil will wash ashore and damage coastal habitats by moving the oil from the surface into the interior of the ocean. Dispersants do not remove the oil from the ocean; therefore, it is important that we not adopt an out of sight, out of mind attitude.

Moving oil below the sea surface presents significant challenges to the organisms residing in this habitat. Impacts will be less noticeable but could be as devastating as oil washing ashore.

Ultimately, microorganisms degrade most of the oil spilled in the ocean. Dispersants are presumed to speed up this process by making the oil more accessible. The rate of degradation is a function of many factors, including temperature, nutrient concentrations, and the abundance of the microorganisms that are capable of consuming the oil.

Now, our entire knowledge of the effects of oil dispersants is from their application at the sea surface. The Deepwater Horizon spill presents a much different scenario, where the dispersants were introduced at the wellhead, approximately 1,500 meters below the surface.

As we continue to [unclear] oil from the deep ocean, it is reasonable to assume that we will face similar scenarios in the future. Therefore there is an urgent need to understand the ultimate fate of the oil dispersed at depth before we continue to apply dispersants in this manner.

While we have some understanding of how microorganisms respond to dispersants at the surface we know nothing of how they do so in the deep sea. There are far fewer microorganisms in the deep sea compared to the surface. This, combined with the lower water temperatures, will result in a slower rate of degradation, leading to a much more persistent plume of oil in the subsurface.

In addition, by keeping the oil away from the surface the evaporation of the volatile fraction of the oil is eliminated, and the probability of entraining oil into the sediments is increased. If the oil is concentrated into the sediments a lack of oxygen will dramatically decrease the degradation rate, leading to long-term contamination of the sea floor.

It will be difficult to assess the changes that occur as a result of the oil and dispersants in the deep sea community given our limited knowledge of the pre-spill community structure, particularly with regard to microorganisms. Working in the deep sea presents many challenges, but it is essential to address these if we are to understand the impact of the large scale experiment that has just been conducted in the Gulf of Mexico. And we need to do so quickly.

In light of our lack of knowledge of the environmental effects of dispersants in the ocean, the initiation of a National Research Plan for oil spill response is warranted. This research plan should call for and support peer-reviewed research in all environmental aspects of oil spill response, including the dispersal of oil in the deep sea.

It is critical that the initiative address the following issues: The development of a set of best practices for experiments addressing the impact of oil and dispersants in the ocean. This will allow for the direct comparisons between types of dispersants, types of oils, and habitats as well as between laboratories conducting the research.

The establishment of a baseline data set on environmental conditions in the water column and sea floor of oil-producing areas of the ocean, including biodiversity, biological production, water current profiles, and sediment characterization.

The development of long-term ecosystem-level studies of the environmental effects of the use of dispersants, including field, mesocosm, and laboratory scale studies.

The engagement of the Nation's academic and Government research infrastructure to assist in this endeavor, including research vessels, undersea robotics, moored instruments, vessels of opportunity, experimental mesocosm facilities, and computer modeling facilities.

The development of an online, open access data base to serve as a repository for the scientific community.

And the establishment of a significant outreach effort to disseminate the results of this research to stakeholders outside the scientific community.

These efforts should result in the ability to better predict the environmental consequences of dispersants under different scenarios for use in formulating specific emergency response plans.

Thank you.

[The prepared statement of Mr. Smith follows:]

Testimony of David C. Smith, PhD
Professor and Associate Dean
Graduate School of Oceanography, University of Rhode Island
Before the
Committee on Environment and Public Works
United States Senate
Washington, D. C.

"Oversight Hearing on the Use of Oil Dispersants in the
Deepwater Horizon Oil Spill"
August 4, 2010

Good morning, I am David Smith, Professor and Associate Dean at the Graduate School of Oceanography, University of Rhode Island. I appreciate the opportunity to testify on this important subject.

The environmental trade offs associated with the use of dispersants in response to oil spills are difficult to assess and therefore their use remains controversial. Dispersants reduce the chances oil will wash ashore and damage coastal habitats by moving the oil from the surface into the interior of the ocean. Dispersants do not remove oil from the ocean and therefore it is important that we not adopt an "out of sight, out of mind" attitude. Moving oil below the sea surface presents significant challenges to the organisms residing in this habitat. Impacts will be less noticeable, but could be as devastating as oil washing ashore.

Ultimately, microorganisms degrade most of the oil spilled into the ocean. Dispersants are presumed to speed up this process by making the oil more accessible. The rate of degradation is a function of many factors including temperature, nutrient concentrations, and the abundance of microorganisms capable of consuming oil. Our entire knowledge on the effects of oil dispersants is from their application at the sea surface. The Deepwater Horizon spill presents a much different scenario where the dispersants were introduced at the wellhead ~1,500 m below the surface. As we continue to extract oil from the deep ocean, it is reasonable to assume that we will face similar scenarios in the future. Therefore, there is an urgent need to understand the ultimate fate of oil dispersed at depth before we continue to apply dispersants in this manner. While we have some understanding of how microorganisms respond to dispersants at the surface, we know nothing of how they do so in the deep-sea. There are far fewer microorganisms in the deep-sea compared to the surface. This, combined with lower water temperatures, will result in a slower rate of degradation, leading to a much more persistent plume of oil in the subsurface. In addition, by keeping the oil away from the surface, the evaporation of the volatile fraction of the oil is eliminated and the probability of entraining oil into the sediments is increased. If the oil is concentrated into sediments, a lack of oxygen will dramatically decrease the degradation rate leading to long-term contamination of the seafloor.

It will be difficult to assess the changes that will occur as a result of the oil and dispersants on the deep-sea community given our limited knowledge of the pre-spill community structure, particularly with regards to microorganisms. Working in the deep-sea presents many challenges but it is essential to address these if we are to understand the impact of the large-scale experiment that has just been conducted in the Gulf of Mexico and we need to do so quickly.

In light of our lack of knowledge of the environmental effects of dispersants in the ocean, the initiation of a National Research Plan for Oil Spill Response is warranted. This research plan should call for and support, peer-reviewed research in all environmental aspects of oil spill response including the dispersal of oil in the deep-sea. It is critical that the initiative address the following issues:

- The development of a set of best practices for experiments addressing the impact of oil and dispersants in the ocean. This will allow for direct comparisons between types of dispersants, oils and habitats as well as between laboratories conducting the research.
- The establishment of baseline datasets on environmental conditions in the water column and seafloor of oil producing areas of the ocean, including biodiversity, biological production, water current profiles, and sediment characterization.
- The development of long-term ecosystem-level studies of the environmental effects of the use of dispersants including field, mesocosm and laboratory-scale studies.
- The engagement of the nation's academic and government research infrastructure to assist in this endeavor including:
    - Research vessels
    - Undersea robotics
    - Moored instruments
    - Vessels of opportunity
    - Experimental mesocosm facilities
    - Computer modeling facilities
- The development of an online, open-access database to serve as a repository for the scientific community.
- The establishment of a significant outreach effort to disseminate the results of this research to stakeholders outside the scientific community

These efforts should result in the ability to better predict the environmental consequences of dispersants under different scenarios for use in formulating specific emergency response plans.

Response to follow up questions to the US Senate Environment and Public Works Committee - Oversight Hearing on the Use of Oil Dispersants in the Deepwater Horizon Oil Spill - 4 August 2010.

David C. Smith
Professor
Graduate School of Oceanography

Senator Boxer

1. ***Professor Smith, you have stated: "The rate of degradation [of oil] is a function of many factors including temperature, nutrient concentration, and the abundance of microorganisms."***

   How different is the gulf's seabed environment compared to the conditions in which researchers normally base anticipated rates of oil degradation?

1. Most studies of oil degradation in the ocean have been done at the surface or on the beach. Some of the dispersants were injected into the oil stream at the well head in a water depth of ~1,500 meters. This environment can be characterized as cold (~ 4°C) and under high pressure (~150 atmospheres). Temperatures this low can be found in surface waters at higher latitudes (e.g. Exxon Valdez spill occurred in cold waters) but pressure is strictly a function of depth. The growth rates of bacteria that are adapted to live at the low temperature and high pressure grow more slowly than bacteria at the surface. Both the abundance and growth rates decline exponentially from the surface to the bottom of the sea. This phenomenon is found throughout the world's ocean and is attributed to decreasing temperatures, increasing pressure and reduced food supply as a function of depth.

2. ***Professor Smith, your testimony suggests that the nation undertake the "development of a set of best practices for experiments addressing the impact of oil and dispersants in the ocean...[and] [t]he development of an online, open-access database to serve as a repository for the scientific community."***

   Could you please describe the main benefits for assessing the use of dispersants in oil spills that you would expect from the development of these types of research tools?

2. The establishment of a set of best practices is commonly done so that data from experiments from one laboratory and be directly compared to those from another laboratory. Once established, a researcher could perform experiments with organisms that they are interested in and be able to compare the effects (e.g. degradation rate, toxicity etc.). with studies done on other organisms without the typical caveats regarding differences in how the experiments were conducted. These practices should be applied to large-scale experiments done that are addressing the effects on marine communities, not just individual organisms. I

believe these experiments will yield data that are more valuable than the acute toxicity tests that are routinely performed. A set of best practices has just been established for scientists conducting research on ocean acidification. (Riebesell U., Fabry V. J., Hansson L. & Gattuso J.-P. (Eds.), 2010. Guide to best practices for ocean acidification research and data reporting, 260 p. Luxembourg: Publications Office of the European Union.)

Senator Sanders

1. **The combination of dispersant and oil appears to be of greater risk to aquatic organisms than dispersant or oil alone. What research are your institutions conducting relevant to the toxicity of the dispersant-oil combination, or can you discuss any prior research about the effects of this combination?**

1. I am not convinced that modern dispersants are categorically more toxic to marine organisms than the oil alone. Some data suggest that is true while other data do not. The original dispersants used in the 1970s were most certainly more toxic to organisms than the oil alone. There are a wide array of dispersants available for use today but I am concerned that we do not have sufficient data on their toxicity. I was very disappointed to learn that the EPA studies on the comparative toxicity of Louisiana Sweet Crude (LSC) and chemically dispersed LSC to two Gulf of Mexico aquatic test species were not conducted until after the spill had occurred. While I do not think that the short-term acute toxicity tests conducted are relevant to the conditions of this spill, they do provide some useful information on the relative toxicity of the various dispersants. Particularly relevant to this spill, the dispersant ZI-400 appears to be ~40 times more effective in dispersing the Louisiana Sweet Crude than Corexit 9500A, the dispersant used in the spill but the toxicity of the oil/dispersant mixes are similar. This can be interpreted in either 40 times less dispersant could have been deployed at the well head to achieve the same level of oil dispersal, or a similar amount could have been deployed to increase the dispersal. My main point is that these experiments should have been conducted long ago and the appropriate dispersants, based on the type of oil and the environmental setting, should be known and the best dispersant for the particular situation be on hand in case of a spill. This should be done now, including long-term, ecosystem level experiments in order to be ready if we find ourselves in a similar circumstance.

Senator Inhofe

1. **How much research has been done on the microorganisms that break down the oil naturally?**

1. There are many bacteria that are known to degrade oil. Oil is a naturally occurring compound that some bacteria use as a food source much like other forms of organic carbon. Because of the natural seepage of oil in the Gulf of

Mexico there are many bacteria that reside in the gulf that have evolved to utilize oil as a carbon source. It is my opinion that the release of the large volume of oil into the Gulf of Mexico will result in the selection for bacteria that can degrade the oil. Once the oil is gone from the system, these bacteria will no longer have a competitive advantage and should relax back to their normal distributions. The issue that makes the Deepwater Horizon spill different is that some of the oil was dispersed at depth (~5,000 ft). Much of what we know about microorganisms that are capable of degrading oil is based on research that is conducted at under routine laboratory conditions. These are typically done at atmospheric pressure whereas the microorganisms that are now being counted on to degrade the oil at depth work under much different conditions (low temperature and high pressure). If we are to continue the practice of applying dispersants in deep water, we need to better understand how the microorganisms will respond under these conditions. Experiments conducted at high pressure are inherently more complicated but we do have the ability to address these questions.

Senator WHITEHOUSE. Thank you, Dr. Smith.

Our next witness is Edward B. Overton. Dr. Overton is a Professor Emeritus with the Department of Environmental Sciences in the Louisiana State University School of Coast and Environment, with over 34 years of experience studying the impacts of oil spills. We are delighted that he is here and look forward to his testimony.

Dr. Overton.

STATEMENT OF EDWARD B. OVERTON, PH.D., PROFESSOR EMERITUS, LOUISIANA STATE UNIVERSITY DEPARTMENT OF ENVIRONMENTAL SCIENCES, SCHOOL OF THE COAST AND ENVIRONMENT

Mr. OVERTON. Senator, thank you very much. Not often does an academic scientist get to appear on the Late Show with David Letterman and testify before the U.S. Senate in the space of a few weeks. So this is indeed an honor for me, and quite an unusual experience, I might add.

I find myself in an interesting position of agreeing with almost everything that has been said, both by the Senators in their opening comments and by my colleagues here so far. Oil, the lesson here is an ounce of prevention with an oil spill is worth a pound of cure, many pounds of cure. Clearly, what we can do to not have an oil spill, a deepwater oil spill, is worth an awful lot of attention.

Having said that, we weren't presented with an ounce of prevention; we had to come up with a pound of cure. And when you are talking about an oil spill, there are a couple of facts that are important to understand what happens when this oil enters the environment. First of all, this was a unique spill because it was a deepwater spill. So oil entering the water, some of it stayed down in the deep oceans, and it is still there in the deep oceans. It has been dispersed; it is moving around by currents. Most oceanographers suggest that that oil down in the deep oceans will be degraded, but it won't come up onto the shelf an impact the coastal areas.

Much of the oil did reach the surface. As it came up it was stripped of a lot of its organic chemicals as it worked its way up to the surface. We are seeing evidence of that now in some of the oily material. Oil that reached the surface, oil that enters the environment undergoes a series of weathering processes. So you are left with trying to clean up not just oil, but oil and all the weathered products.

There are difficult decisions to be made, because as the oil changes, it changes its toxicity, its physical properties, its chemical properties. So you are trying to clean up an elusive target.

But having said that, there are three tools in the tool box to get oil off the ocean surface. And those three tools are: you can use mechanical means, skimming, sucking, clean up like that. You can use chemical means, and the means that we were using in this spill, are dispersants. And you can use in situ burning.

In a perfect world I am a big fan of skimming, because skimming allows you to retrieve the hydrocarbon material, and it can be recycled. So if you can skim it, you should. And it should always be your first preference. If the oil is thick enough to burn, it is thick enough to skim and recycle. So I think everybody is in favor of recycling.

Unfortunately, because the oil came up to the surface and spread out, we weren't left with that option. And the option we're using were chemical dispersants. Dispersants are a soap for oil. It dissolves oil down into the water column. As has been said many times before, I am not going to repeat what has already been said, you are clearly, clearly trading off impacts in the deep ocean with impacts on shore.

One point I have not heard being made is that that dispersant use should always be used in deep offshore water and not near the shoreline. There is just no opportunity for dilution of all hydrocarbons in near-shore environments. So oil should be dispersed offshore.

With this particular dispersant—and I think most dispersants as we are finding out—the dispersed oil is not any more toxic than the oil itself. The oil is what is causing the problem, and of course you are dispersing it in deep water. It is causing damage, as has been adequately described. And we will not know that damage—I totally, totally agree that we need to use this to understand the impacts of oil spills and dispersants. We simply cannot put this much oil in the environment as a grand experiment. It is out there now; we need to take advantage of the research opportunity and the long-term research opportunity to understand the environmental implications both in the deep ocean and at the surface.

Having said that, use of dispersants—we are not through with this event yet, this sorry affair. But looking back right now, Louisiana's 7,700 miles of contiguous coastline has been largely spared from heavy oiling. Seventy-seven hundred miles represents about 40 percent of the Nation's wetlands and is the base of the food chain for something on the order of 80 to 90 percent of the marine harvest. This is an incredibly valuable shoreline that must be protected. The use of offshore dispersants appears to have spared a lot of this environment.

Out of those 7,700 miles something on the order of 200 to 300 miles have been hit and hit pretty hard. We originally saw the pictures of coastal oiling, but it certainly could have been much worse.

So we are not out of the woods yet. We don't know how much more damage has been done. But we do know a few things, and one is that the damage so far is not as bad as it could have been.

Now, we certainly need to monitor for the long-term damage. How long will it take species to come back? And by the way, during an oil spill, this acute event, the damage is done, it will take a little while for us to understand that, and a little while means years. But the damage has been done. We need to assess it; we need to spend the money.

I have a lot more to say, but my red light is on, so I thank you very much for the opportunity.

[The prepared statement of Mr. Overton follows:]

Statement of Edward B. Overton, Ph.D.
Professor Emeritus, Department of Environmental Sciences
School of the Coast and Environment
Louisiana State University
Baton Rouge LA 70803

I am a Professor Emeritus with the Department of Environmental Sciences, in the LSU School of Coast and Environment with over 34 years experience studying the environmental impacts of oil spills. I have also been the principal investigator of grants from NOAA's Office of Response and Restoration to provide chemical hazard assessments during spills of oil and hazardous materials in marine environments under U.S. jurisdiction. I want to thank Senators Boxer and Inhofe for the invitation to testify before this Environment and Public Works Subcommittee.

Dispersants are soaps for oils. They are used during oil spills to break up surface slicks and enhance the natural dispersion of the oily materials into the water column. Dispersants work because they are made up of compounds that have water-soluble parts as well as oil-soluble parts. When sprayed onto oil slicks, the oil looses its attraction for itself (its cohesion), and this allows wind/wave energy to break apart the surface slicks. The oil is then dispersed into the water column as very tiny droplets with micron sized diameters. These tiny droplets have a very large surface area and are much more rapidly degraded by naturally occurring bacteria than is oil floating in large patches on the surface. Further, dispersed oil micro-droplets are also diluted into the water column by ocean currents. Both of these processes, degradation and dilution, work to lessen the impact of oil floating on water surfaces. Dispersants application, however, is not without risk and can cause impacts through water column exposures as well as oxygen depuration. For these reasons, dispersants should only be used in deep water, well off shore.

Dispersant use has been controversial for years because initial formulations were shown to cause more environmental damage than was caused by the oil itself. Over the years, these formulations have evolved, and the current formulations are relatively benign in terms of potential environmental damage from the dispersant. In fact, most of the offshore environmental impacts associated with dispersant use are from the oil that has been dispersed rather than from the dispersant.

Clearly, dispersants should only be used off shore in deep water to lessen the impacts of oil floating on the surface if that slick comes ashore. So, quite simply, the decision for surface use of dispersants represents a trade off between off shore impacts and on-shore impacts. When shoreline impacts include thick oil coating of marshes and coastal grasses, the most vulnerable types of environments to spilled oil, generally the decision will be to protect these valuable coastal recourses and allow off shore dispersant use. This decision implies acceptance of the fact that impacts from oil to coastal marshes will be greater than water column impacts far off shore.

In the Deepwater Horizon incident, in addition to surface use of dispersants, these chemicals have been used at the well-head some 5000 feet below the surface. The primary driving force for this at-depth application was to limit the amount of oil surfacing right above the well-head, since virtually all recovery and relief-well efforts were concentrated in this small area of the Gulf. Subsurface dispersant application greatly limits the inhalation exposure of the rig workers to the oil's toxic evaporative fumes. However, deep-water wellhead dispersant application has never been used, and the environmental impacts are not clearly defined. In fact, very little is know about deepwater ecology, and consequently, very little is known about the toxic and oxygen depleting impacts of dispersant use at depth. Dispersant use at depth is truly a trade off between human exposure verses environmental exposure. Initial testing of these deepwater environments has been very limited, but has not indicated depressed oxygen levels or other environmental impacts at this point.

Over the last several decades, billions of dollars have been paid to the government as royalty income from production in outer continental shelf areas along the northern Gulf of Mexico region. Very little of this royalty income has been used to study the environment, particularly the deep Gulf environment, in the areas that are used for deepwater oil production. Additionally, little money has been applied to develop better engineering solutions to respond to a massive underwater leak and be able to monitor effectively the leak and assess its deepwater damages. Further, little money was spent to understand how oil changes and moves both subsurface and at the surface from a deepwater release. Both surface and subsurface containment and removal technologies need to be developed, and again, no money from the royalty income was used to protect our environment from the impacts of a spill such as the Deepwater Horizon incident. At least a portion of these types of research and development cost should come from government expenditures. Billions of dollars of royalty income from northern Gulf production was used for other purposes. As a consequence, we were not adequately prepared to respond to a massive deepwater spill and evaluate its full impact.

There are three tools in the toolbox to respond to an oil spill: use of mechanical means for oil removal (skimmers, oil/water separators); use of chemicals (dispersants) for oil treatment; and removal of oil by burning (in-situ burning). In the perfect world, skimming with effective oil/water separation should always be the first choice for oil removal. Skimming can allow a significant portion of the spilled oil to be recovered and recycled, thus minimizing waste from the incident. Oil that cannot be skimmed should be dispersed off shore. Oil that is thick enough to be burned is also thick enough to be skimmed, and skimming allows recycling. If skimmers are not readily available, offshore dispersant use and in situ burning are generally preferable to on-shore oil impacts.

According to Nalco, COREXIT 9500 is made up of a mixture of surfactants and solvents. These components, as well as some of their common uses, are listed below. The first four components are approved by the FDA for use in cosmetics, pharmaceuticals, or as food additives. The last two components are use in and around the home.

	CAS #	Name	Common Day-to-Day Use Examples
1	1338-43-8	Sorbitan, mono-(9Z)-9-octadecenoate	Skin cream, body shampoo, emulsifier in juice regulated by the FDA
2	9005-65-6	Sorbitan, mono-(9Z)-octadecenoate, poly(oxy-1,2-ethanediyl) derivs	Baby bath, mouth wash, face lotion, emulsifier in food (e.g., barbecue sauce, ice cream, baked goods); food additive regulated by the FDA
3	9005-70-3	Sorbitan, tri-(9Z)-9-octadecenoate, poly(oxy-1,2-ethanediyl) derivs	Body/face lotion, tanning lotions
4	577-11-7	Butanedioic acid, 2-sulfo-, 1,4-bis(2-ethylhexyl) ester, sodium salt (1:1)	Wetting agent and solubilizer in cosmetic products, gelatin, beverages; food additive regulated by the FDA
5	29911-28-2	2-Propanol, 1-(2-butoxy-1-methylethoxy)-	Household cleaning products
6	64742-47-8	Distillates (petroleum), hydrotreated light	Air freshener, cleaner

ACCORDING TO NALCO, THE COMPONENTS IN COREXIT 9500 are readily biodegradable. In biodegradation studies performed by Nalco using method NFT 90-346, COREXIT 9500 showed 78% biodegradation in 28 days.

Even if compounds are biodegradable, they may accumulate in living organisms. Typically, bioaccumulation is greatest with compounds that are not water-soluble, and their bioaccumulation potential can be measured in laboratory studies by determining a bioaccumulation factor (BAF). Predictive models (e.g., US EPA EPI Suite v. 4.0, 2009) can also be run to evaluate potential bioaccumulation based on physicochemical characteristics. For COREXIT 9500 components, the bioaccumulation factors are in the range of 2.6-208, well below the regulatory bioaccumulation threshold for concern value of 1000. For comparison purposes, the bioaccumulation factor for a known infamous pesticide DDT ranges from 12,000 to 80,000 depending on the species.

Details are given below on the biodegradation and bioaccumulation potential of Corexit 9500A and its components, as supplied by Nalco.

	CAS #	Name	28 Days Biodegradation % (Method)	Bioaccumulation Factor
		Corexit 9500	78 (NFT 90-346) 62 (OECD 306)	2.6 - 208
1	1338-43-8	Sorbitan, mono-(9Z)-9-octadecenoate	62 (OECD 301C)	150 (calc)
2	9005-65-6	Sorbitan, mono-(9Z)-octadecenoate, poly(oxy-1,2-ethanediyl) derivs	31.8 (OECD 306)	3.2 (calc)
3	9005-70-3	Sorbitan, tri-(9Z)-9-octadecenoate, poly(oxy-1,2-ethanediyl) derivs	41.4 (OECD 306)	3.2 (calc)
4	577-11-7	Butanedioic acid, 2-sulfo-, 1,4-bis(2-ethylhexyl) ester, sodium salt (1:1)	66.4 (OECD 301D)	3.47 – 3.78 56 (calc)
5	29911-28-2	2-Propanol, 1-(2-butoxy-1-methylethoxy)-	49.8 (OECD 301D) 96% (OECD 302B)	2.6 (calc)
6	64742-47-8	Distillates (petroleum), hydrotreated light	11% (OECD 301D) 99.5 (OECD 306)	61 – 159

Typical aquatic toxicity values for COREXIT 9500 and its components are given below. Please note, the larger the number, the less toxic the material is to that class of organisms.

	CAS #	Name	Fish LC50 (96h) ppm	Crustacean EC50 (48-96 h) ppm	Algae EC50 (72h) ppm
		Corexit 9500	20 - >400 (9 species)	14 – 83 (10 species)	0.7-20 (2 species)
1	1338-43-8	Sorbitan, mono-(9Z)-9-octadecenoate	>1000	>1000	3 - 970
2	9005-65-6	Sorbitan, mono-(9Z)-octadecenoate, poly(oxy-1,2-ethanediyl) derivs	>1000	1 -250	20 - 1000
3	9005-70-3	Sorbitan, tri-(9Z)-9-octadecenoate, poly(oxy-1,2-ethanediyl) derivs	>1000	267	40
4	577-11-7	Butanedioic acid, 2-sulfo-, 1,4-bis(2-ethylhexyl) ester, sodium salt (1:1)	9.1 - 66	36.2 - 100	9.2- 15
5	29911-28-2	2-Propanol, 1-(2-butoxy-1-methylethoxy)-	841- >1000	>1000	138 - 441
6	64742-47-8	Distillates (petroleum), hydrotreated light	2.4 – 1740	23.6 - 4720	4.1 - >5000

COREXIT 9500 has been used in the United States as an effective tool in the event of an oil spill. The components of COREXIT 9500 are well known, and possess well-established biodegradation and ecotoxicity profiles that provide evidence that use of this dispersant in offshore environments will have minimum impact on the environment.

Oil dispersed into the water column will have environmental impacts on organisms exposed to the oil, and can have the potential to cause oxygen depletion in the water column due to natural biodegradation of the oil. Dispersant use represents a trade off between the areas of the environment that will be impacted to the greatest extent if covered with oil. Oil spills cause environmental damage, some very obvious, but much of the damage is to the very small, tiny organisms that are the basis of the ecological life cycle (larval and juvenile life cycle organisms) in both near shore and off shore marine environments. These damages are not readily observed during a spill and may not be obvious for several years after the damage takes place. Dispersant use will enhance the damage to these tiny organisms because it spreads the oil below the surface rather than leaving the oil concentrated on the surface. Therefore, offshore dispersant use represents a decision by responders that damage from on-shore oiling will be more severe than damage to offshore environments. In essence, the choice is discerning the "lesser of two evils", and is always a difficult decision because offshore dispersant use does cause environmental damage in the water column. However, oiling of grassy marshes is generally considered to cause more environmental damage from an oil spill, so offshore dispersant use is normally considered the "lesser of the two evils".

Senator Sanders:

Q: The combination of dispersant and oil appears to be of greater risk to aquatic organisms than dispersant or oil alone. What research are your institutions conducting relevant to the toxicity of the dispersant-oil combination, or can you discuss any prior research about the effects of this combination?

A: Dispersants certainly do allow oil to be dispersed or mixed into the water column. This process allows more oil to be available for exposure to animals swimming in the water column near where the dispersants were applied that would be available if the oil were left floating on the water's surface. Consequently, dispersion poses a greter risk to the aquatic environment in the area where the dispersion occurs. This is the reason chemical dispersion should only be used well offshore in deep water where the dispersed oil can be diluted to below dangerous levels in the water column, and in areas where is biological density of marine life is very significantly lower than in near shore coastal waters. The process of offshore oil dispersion is only used to keep large quantities of oil from coming ashore where significantly greater damage can occur to aquatic life.

It is important to point out that the greater risk associated with the combination of dispersant and oil comes from the fact that dispersion of oil into the water column provides a route of exposure to the toxic components in oil for the aquatic life. This risk is not, in general, associated with the toxicity of the dispersant, which is always used in much smaller quantities than the oil. Most of the toxicity effect from the use of dispersants comes from a dramatic increase in the route of exposure potential to the compounds that make up oil, some of which are toxic to marine organisms.

Senator Inhofe:

Q1: It is my understanding that dispersants simply break up the oil and speed the natural degradation of the oil, which is done by micro-organisms. Is this an accurate depiction of what they do, and if so, wouldn't leaving pure oil to be biodegraded by the micro-organisms for a much longer period of time be much worse for the environment?

A1: As a general rule, definitely yes. Dispersing oil well offshore means that much less oil has the potential to come ashore. Shoreline impact, in general, causes more environmental damage that offshore dispersion, but there are impacts to the offshore environment. Dispersant use is a trade-off between accepting less near shore damage for more offshore damage. Ultimately, the real question is, does offshore oil have greater or lesser environmental impacts than near shore oil. For a number of reasons, most scientists, I believe, realize that near shore impacts can be significantly greater than offshore impacts, so dispersion in deep offshore waters is the better alternative.

Q2: Judging from the current reports that dispersants have been successful, with no discernable concomitant environmental damage, would you support a moratorium on the use of dispersants for further study?

A2: I think it is a bit too early to draw any conclusions about the damage done from use of dispersants because some of the damage may take several years to become obvious. Having said this, most current indicators suggest that dispersant use prevented massive shoreline oiling from this spill, thus preventing massive shoreline/near shore impacts. For these reasons, I would not support a moratorium on dispersant use for further study.

Q3: You have been quoted during interviews discussing the potential health benefits of dispersant to oil spill cleanup workers. Could you please elaborate on that subject.

A3: Dispersant use at the wellhead ultimately prevented very fresh oil from coming straight up to the surface above the leaking wellhead. This location, called ground zero, is where much of the effort was concentrated to drill relief wells and contain the spilled oil in recovery vessels. Preventing large quantities of oil from surfacing in the ground zero zone prevented exposure of the offshore workers to the toxic vapors of the evaporating oil. This wellhead dispersion probably had little effect on cleanup workers in near shore environments working to remove oil from shoreline.

Q4: During your testimony you also discussed the natural seeps that occur in the Gulf and how much oil they put into the ecosystem naturally. Could you also give more information on that subject.

A4: Oceanographic scientists who study the deepwater environments in the Gulf, as well as oil exploration and production engineers have long realized that significant oil leaking into the Gulf meant that there was recoverable oil in underground deposits nearby. These scientists and engineers have extensively mapped to Gulf's bottom and discovered many natural seeps that put an estimated 20,000,000 gallons or more of oil into the Gulfs environment each year and this has been occurring for thousands of years. The implications of these seeps are currently an active topic for research. However, many seep areas are associated with very active biological communities that ultimately live off of the bacteria that degrade the seeping oil. This means that the Gulf's environment is acclimated to readily and rapidly degrade oil. The full implications of this acclimation have yet to be completely elucidated, but obviously this ability to rapidly degrade oil is an important mechanism in the Gulf's ability to naturally heal itself from this massive spill.

Senator WHITEHOUSE. Thank you, Dr. Overton. I look forward to giving you a chance to have more to say during the question and answer period.

Our final witness is Jackie Savitz. She is the Senior Scientist with Oceana. Prior to that, she served as Executive Director of the Coast Alliance, as an environmental policy analyst with the Environmental Working Group, and as an environmental scientist with the Chesapeake Bay Foundation. We are delighted to have her here and welcome her testimony.

Ms. Savitz.

STATEMENT OF JACQUELINE SAVITZ, SENIOR CAMPAIGN DIRECTOR, OCEANA

Ms. SAVITZ. Thank you, Senator, and thank you so much for inviting me to be here today.

As you know, Oceana is a global conservation organization, and we are dedicated to restoring and protecting the oceans. Since the Deepwater Horizon blowout our Nation has been shaken by an unprecedented oil spill that has directly caused 11 deaths, put many people out of work, shut down fisheries and threatened businesses that depend on the oceans.

Marine life affected by the spill include endangered, threatened, and commercially important species. Many questions have arisen, including whether or not dispersant chemicals should be deployed. The answer is not an easy one, as you have heard. Once the oil hits the water there simply are no good ways to stop it or to clean it up. There are pros and cons to dispersant use and their use is clearly a lose-lose proposition that requires a choice between a lesser of two evils.

If we are continually asking the oceans to take one for the team, we ought to be making sure we don't repeat the same mistake. Since we can't prevent, contain, or clean up oil spills without major ecological impacts, we need to stop offshore drilling, promote alternative energy sources, and transition oil and gas workers to the clean energy sector. If drilling must continue there must be effective plans for prevention, response, and clean up. But currently those do not exist.

Dispersants can be effective at dissolving oil and removing it from the surface, where it threatens diving birds, surfacing marine mammals, and sea turtles. They prevent some of the oil from reaching land where it would wash up on beaches and marshes and pose risks to public health.

However, they also help to dissolve oil in the water column, where fish and other marine life are continually exposed. Oil dispersants and their mixture can kill marine life, they can affect reproduction, growth, disease resistance, digestion and a long list of other critical life activities. Their use also prevents skimming and collection of meaningful amounts of oil.

The required lesser of two evils decision is made without the benefit of a crystal ball. The science does not fully address the impacts on key species like corals, or sensitive life stages, or ecosystems. Even if we had that information, there is no calculus that can compare the ecological benefits to the ecological costs and come out with a right answer. It is a trade-off. The decision to use dispersants may have saved some birds in marshes while increasing the impacts on fish and other marine life. How can we say which is more important?

There have been many lose-lose decision. Do we use dispersants or not? Do we burn off the oil off the water surface or not? What about flaring off oil and gas with the inherent air pollution, or not flaring it? I could go on.

If we are going to have to ask the oceans to take one or many for the team, we should in response take all necessary measures to make sure the situation is not repeated. That means making sure there are no more oil spills where dispersant chemicals are considered the best option.

Since drilling has so clearly been shown to be unsafe, unpredictable, and damaging, the only way to effectively prevent this type of spill and its consequences is to stop offshore drilling. Oceana recommends a ban on new offshore drilling.

Given what we know about the inadequacy of spill response, the side effects of dispersants, and the frequency of spills, it would be a tragic mistake not to use this opportunity to devise a plan to replace our oil demand and stop drilling offshore. There are clear options that could allow us to accelerate our shift to clean energy.

We recommend that a blue ribbon panel of experts be appointed to engage the brightest minds to formulate a plan to fast track that shift to clean energy. This should include development of a clean energy manufacturing hub in the Gulf region to allow for a just transition of oil and gas workers to the clean energy jobs.

Finally, while Oceana argues that the drilling should stop, at the very least no drilling permits should be approved without plans for spill prevention, response, and clean up that do not rely on lose-lose decisions and that do not make our oceans and all who depend on them the biggest losers.

If there are no adequate technologies or no safe chemicals to respond to spills, then drilling simply should not be allowed.

As far as dispersants, the only good answer is to avoid having to trade the health of fish for the health of marshes or the survival of corals for the survival of sea birds. If we fast track to clean energy we could build an energy to replace dirty and dangerous jobs with clean jobs, one that powers our daily lives without releasing carbon dioxide and contributing to climate change and one that stimulates our economy and provides us with exports.

Countries like Germany and China are already making these investments. We can stick with oil and gas and import our energy technology from them, or we can use this opportunity to change course and become the exporters. We could be the Saudi Arabia of clean energy technology.

Thank you, Mr. Chairman.

[The prepared statement of Ms. Savitz follows:]

Written Testimony of Jacqueline Savitz, Senior Campaign Director, Oceana

Senate Committee on Environment and Public Works

"Oversight Hearing on the Use of Oil Dispersants in the Deepwater Horizon Spill"

August 4, 2010

Introduction

Good morning. My name is Jacqueline Savitz, and I am Senior Campaign Director for Oceana, a global ocean conservation organization based here in Washington, D.C. that works to restore and protect the world's oceans. Besides our headquarters in Washington DC, Oceana also has staff located in Alaska, California, Florida, Louisiana, Oregon, and Massachusetts, as well as international offices in Brussels, Belgium; Madrid, Spain; and Santiago, Chile. We have 400,000 members and supporters from all 50 states and from countries around the globe. Our mission is to protect our oceans and the fish and wildlife that depend on them.

Today, I will present testimony regarding the use of chemical dispersants in the Deepwater Horizon drilling disaster, as well as the lessons learned from the spill and the need to protect our oceans from threats posed by oil and gas development on the outer continental shelf of the United States.

The Deepwater Horizon Oil Spill

In the past three months, our nation has been shaken by an oil spill of unprecedented proportions. The Deepwater Horizon blowout and subsequent three months of oil flow rivals the worst accidental oil spills in world history. It has directly caused 11 deaths, and it has put an untold thousands of people out of work. It has shut down fisheries, and threatened businesses that depend on tourism in five states. While we are beginning to see the end of the spill itself, its impacts will continue, perhaps for decades.

Marine life affected by the spill ranges from the smallest marine zooplankton species which play an important role at the base of the food chain, to commercially important species of oysters, fish, crabs, and shrimp. It includes four endangered and one threatened species of sea turtles, as well as the prized Atlantic bluefin tuna, whose populations have been depleted by overfishing to about 10% of historic levels. One of only two spawning grounds on the planet for Atlantic bluefin tuna was marred during spawning season this year with a mixture of toxic oil and chemical dispersants at the exact time that the species tends to release its eggs. This habitat has continued to be contaminated through the hatching period and the most sensitive life stages of the Atlantic bluefin.

The blowout of the well occurred, and the spill continued, through a time period that is for many species a spawning, breeding, nesting and or hatching season. Oil, chemical dispersants, and drilling muds are all toxic to marine life. Some species are more sensitive than others; however, it is clear that larvae and juveniles of most species are the most sensitive life stages. For animals, such as sea turtles and bluefin tuna, which are already struggling to maintain their populations, the implications of this contaminated habitat could be devastating. Young may not survive long enough to bolster adult populations, and may not contribute reproductively as a result. For other species, the spill threatens to destroy habitat, deplete food sources, or otherwise shake up the balance of the ecosystem in ways that may have long term and even detrimental effects.

The effects of the spill on these species or on the complex marine ecosystem as a whole may not be known for decades, and the full effects may never be clear. The thousands of birds that have been found dead are likely indicators of thousands more that were never found. The same is true for sea turtles, marine mammals fish and invertebrates. Many animals affected by the spill won't be counted, some may drift about in the Gulf and many will likely be scavenged by other animals. The effects on populations may be difficult to determine for a number of reasons. For example, baselines are not always available, it can be difficult to assess population sizes, and other stresses on the species may cloud an assessment of the impacts of the spill.

However, the devastation that is apparent, the lost lives, the livelihoods that have been destroyed, and the marine life that have been affected, while perhaps just the tip of the iceberg, gives a clear indication that the benefits of offshore drilling do not justify the risks.

The remainder of this testimony focuses on the following points:

- **There is no way to create an effective response plan for a major oil spill.**
- **Dispersant use is a lose-lose proposition.**
- **Offshore drilling can not be done safely.**
- **We can make offshore drilling unnecessary.**
- **We can protect the oceans from oil while also improving the economy.**

There is no way to create an effective response plan for a major oil spill.

Once a blowout or other spill occurs, there are few if any effective solutions. Those that have been proposed and tried are not very effective. Only a small percentage of the oil that reaches the ocean waters can be recovered. And techniques such as burns, dispersant chemicals, barrier islands and booms are either ineffective, or have major down-sides, or both. The only effective way to prevent the devastation that follows an oil spill is to respond before it happens, and prevent it from occurring in the first place. Since this spill has shown so clearly that response capabilities are inadequate, the only sure way to prevent marine and other impacts is to say "no" to offshore drilling in the first place.

Dispersant use is a lose-lose proposition.

One lesson learned from the Deepwater Horizon disaster is that if drilling must proceed, at the very least there need to be effective oil spill response plans, devised *a priori*, before the drill hits the Earth's crust, not as part of the response process itself.

If the government insists on granting permits to drill, that permission should be conditioned on a demonstration that the companies asking for the rights to drill offshore have the capacity to prevent a spill, to contain a spill and to clean up a spill. None of these requirements were met in the case of the Deepwater Horizon permit, and it appears that the same is true for many ongoing offshore drilling operations, and planned drilling projects. This is unacceptable.

An effective response plan should not include activities that, in themselves, are harmful to the marine environment. The use of dispersant chemicals is perhaps the best example of this; however, on-site burns and the burning off of oil and gas collected, as was done in the Deepwater Horizon disaster are also examples of response activities that impact the marine environment. Each of these activities also has public health implications. In spite of the fact that they are not effective and that they cause collateral damage to marine life, these activities have, in the past, been considered sufficient to make up a response plan.

However, response activities that require further contamination of the water column, or that result in the release of undetermined amounts of air pollution such as particulate matter, carbon dioxide, and sulfur and nitrogen oxides, for example, is not a solution, it's just another piece of the original problem.

This is clearly the case with chemical dispersants. Dispersants do have an up-side. If applied within 24 hours of the spill, they are effective at dissolving the oil, and removing it from the surface, where it is otherwise a threat to diving birds, surfacing marine mammals and sea turtles. In doing so they prevent some of the oil from reaching land, where it would wash up on beaches and marshes, and pose risks to public health.

However, their use results in more oil being dissolved into the water column where fish and other marine life are continually exposed to it. As a result, dispersants increase the time period in which aquatic life is exposed as well as the areal extent of exposure in the water column[1]. Because toxicity is a function of dose and time period of exposure, this increases the number of aquatic animals that are subjected to toxic conditions as well the degree of toxicity.

In addition to making the oil more-available to marine life, dispersants themselves can be toxic to marine life, depending on the concentration. Moreover, the dispersant oil mixture can be more toxic than either of the two chemical mixtures alone, and in some cases their toxicity is synergistic, meaning that it is greater than the additive toxicity of the two mixtures. Furthermore, once the dispersant is mixed with oil, especially at depth, it is no longer possible to skim the oil or to collect any meaningful amount of it.

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[1] National Research Council. 2005. Oil Spill Dispersants: Efficacy and Effects. The National Academies Press. 377pp.

Oil, dispersants, and their mixture can have a wide variety of both acute and chronic effects on marine life. Some exposure can be lethal, but for those animals that survive it, these chemicals can affect reproduction, growth, disease resistance, digestion, and a long list of other essential life processes. However, little is known about the toxicity of dispersants, including those that have been pre-approved for use by the Environmental Protection Agency. These chemicals have been tested on only a small subset of species, not necessarily inclusive of the most sensitive in a given drilling area. For example, data are not available on the full effects of these chemicals on the deepwater corals present near the drill site. These may be among the most sensitive species exposed to the chemicals, and they are slow growing. If affected by the chemical exposure they will take many years for them to recover.

The bottom line is that drilling permits have been systematically approved for thousands of wells based on response plans that are reliant on chemical solutions that are at worst, largely untested, and at best, toxic to the few marine animals on which they have been tested. Rather than providing an adequate response, this guarantees that there will be environmental impacts on marine life in the case of an oil spill, and spills are unfortunately much more common that one might think.

Offshore drilling can not be done safely.

Despite claims from many supporters of the industry, spills happen frequently, and not just from tankers. After the Montara spill, in 2009, a blowout in shallow water off the coast of Australia, which took more than two months to contain, it was clear that this could happen again and that it could happen in the United States. The technology being used in that case was not old-fashioned. It was the newest technology, the kind that many have argued is as safe and could not result in a spill. But it did result in the Australian spill, and about a year later, the newest technology again failed to prevent the devastating spill in the Gulf of Mexico.

Offshore drilling is a dangerous and dirty business. Besides the 11 lives and the 100 to 200 million gallons spilled in this case, the United States Minerals Management Service reports that there have been at least 21 offshore rig blowouts, 513 fires or explosions offshore and 30 fatalities from offshore oil and gas activities in the Gulf of Mexico since 2006[2].

Given what we now know about the inadequacy of spill response, the side effects of dispersant chemicals, and the frequency of spills, we would be remiss not to determine exactly how we replace our oil demand with clean energy.

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[2] Minerals Management Service (2010).
http://www.mms.gov/incidents/blowouts.htm
http://www.mms.gov/incidents/fatalities.htm
http://www.mms.gov/incidents/firesexplosion.htm

We can make offshore drilling unnecessary.

Additional offshore oil drilling will not lower gas prices, and it will put many jobs at risk. In 2009, the United States Department of Energy (DOE) estimated that by 2030 gasoline prices would be $3.88 per gallon if all the U.S. oceans were open for drilling – that's just three pennies less than if previously protected ocean areas remained closed[3].

Oil is a global commodity, therefore additional U.S. oil supply from additional offshore oil drilling would have to be significant enough to alter the global price of oil in order to impact local gasoline prices. The United States simply cannot produce enough oil from the limited resource in its offshore areas to make a difference on global oil prices. Yet at the same time, as we have seen, an oil spill can threaten the livelihoods of thousands of fishermen as well as those in the restaurant, hotel and other industries who rely on coastal tourism.

The only way to become truly energy independent is to end our addiction to oil and begin relying instead on clean energy. The United States Department of Energy (DOE) estimates that even if we opened all of the offshore areas to drilling, the U.S. would still import about 58% of its oil supply. Currently, about 62% of the crude oil supplied to the United States comes from foreign sources, with the top two suppliers being Canada and Mexico[4]. Importing more than half of our oil will not allow us to be energy independent, yet that is the best case scenario, even if we develop all of our offshore reserves.

The United States simply does not have enough domestic oil to reduce its dependence on imports, much less to fulfill its demand. The best way to eliminate foreign oil dependence is to eliminate dependence oil itself by developing alternative sources, rapidly switching to plug-in and electric vehicles and phasing out oil consumption in other portions of our economy like home heating and electricity generation.

Preliminary analysis by Oceana has demonstrated that the economically recoverable oil and gas on the Atlantic Coast would provide less energy, for a greater cost and create fewer jobs than if the same resources were invested in developing offshore wind. Because offshore wind development is competitive with offshore oil for installation vessels, maritime expertise and other needs, developing both would be economically inefficient. This suggests that expanding drilling in the Atlantic is unnecessary and, in fact, counterproductive to the development of a clean energy economy.

Only 8% of the oil used in the United States comes from the Gulf of Mexico. This amount could be replaced by a combination of 1) increasing efficiency of home heating by shifting some oil heated homes to electric heat; 2) electrification of a portion of the U.S. vehicle fleet; 3) slowing ships to increase fuel efficiency and save costs; 4) shifting

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[3] United States Department of Energy (2010).
http://www.eia.doe.gov/oiaf/archive/aeo09/pdf/0383(2009).pdf

[4] United States Department of Energy (2010).
http://www.eia.doe.gov/oiaf/archive/aeo09/pdf/0383(2009).pdf

the small amount of oil driven power generation to clean power, such as offshore wind; and 5) carefully increasing the use of advanced biofuels that come from non-food crops, prioritizing those with minimized energy costs. If we also begin to feed the electric grid with clean energy, from offshore wind, for example, these additional electricity demands will not have to be met by fossil fuels.

These steps could allow the U.S. to stop offshore drilling without increasing imports. If developed further they ultimately could also alleviate the need for imports from countries that are not U.S. allies.

Because there are clear options that, if developed, could allow us to accelerate our shift to a clean energy economy, we believe that a Blue Ribbon Panel of experts should be appointed and charged with developing a plan to make these changes as soon as possible. While the President's BP Deepwater Horizon Oil Spill and Offshore Drilling Commission is not charged with recommending alternatives to offshore drilling, the impacts of the Deepwater Horizon clearly demand that we ask these questions and find a way to break our oil habit. We should have the brightest minds in the U.S. engaged to develop a plan to fast-track the shift to clean energy.

We Can Protect the Oceans from Oil While Also Improving the Economy.

The subject of this hearing is the use of dispersant chemicals in the Deepwater Horizon oil spill. The decision to use dispersants is perhaps the best example of the many "lesser of two evils" decisions that have had to be made as a result of the Deepwater Horizon spill. This call had to be made without the benefit of a crystal ball. There is no calculus to allow scientists to compare the ecological benefits of dispersant use to its ecological costs, and come out with the "right" answer for the oceans. The decision is a trade-off between surface oil slicks and oiled shorelines, versus oil and dispersants in the water column. The result of the decision to use dispersants is more oil and dispersants in the water column and more exposure to fish and invertebrates that live in the oceans[5].

This decision required the oceans and marine life to "take one for the team." The full effects of these actions may not been known for some time, if ever. However, it is important to recognize that this was not a "solution" or an "effective response." Rather it was a major detriment to our oceans, an insult following an already damaging injury.

The use of dispersants was just one of the "lesser of two evils" choices that result in harm to our oceans There was the debate over burning oil off the water surface, or not burning it and the concerns about burning off the collected oil and gas because of the inherent and unmitigated air pollution it creates. There was the question of whether after the well was capped, whether the cap may need to be removed if there was a leak in the pipe which would mean more gushing oil into the ocean, to prevent a worse situation from developing around a new lead that may be identified. There has been a debate about the impacts of building barrier islands to stop oil flow into the marshes. There are concerns about the impacts to the marshes from all the additional activities needed for spill

[5] National Research Council. 2005. Oil Spill Dispersants: Efficacy and Effects. The National Academies Press. 377pp.

response. The oceans and marine ecosystems have suffered from more than just an oil spill. They have borne the brunt of many lose-lose choices that were necessary once the oil hit the water.

If we are going to have to ask the oceans to "take one, or many, for the team" we should, in response, take all necessary measures to make sure the situation is not repeated. That means making sure there are no more oil spills, and no more situations where dispersant chemicals are considered the best option. Since the drilling process has been so clearly shown to be unsafe, unpredictable and damaging, the only way to effectively prevent this type of spill and the consequent additional impacts, is to stop offshore drilling.

Recommendations

With the potential to develop clean energy solutions that could reduce our need for oil, create jobs and build our economy, the prospect of ending offshore drilling could lead to major benefits. Doing so could reduce and ultimately end the need for debate over dispersants, and other "lesser of two evil" decisions. Oceana therefore makes the following recommendations:

Stop Offshore Drilling
We have learned from the Deepwater Horizon disaster that we are not prepared to respond to an oil spill. Techniques that have been promised in response plans have proven ineffective, and often, as in the case of chemical dispersants, are used only at the expense of the marine ecosystem. The insufficient response capabilities, combined with the inability to prevent spills and to fully restore ecosystems to pre-spill conditions justify a permanent ban on offshore drilling.

Stimulate Clean Energy Solutions
By stimulating clean energy solutions, such as solar power, onshore and offshore wind energy, geothermal energy and energy efficiency, we can replace the oil we would obtain from the Gulf of Mexico, and then some. In doing so we could alleviate the risks of offshore drilling while also strengthening the U.S. position in clean energy technology. One part of this should include stimulating the development of a clean energy manufacturing base in the Gulf Region to allow a transition of oil and gas workers to clean energy jobs. Developing these clean technologies and manufacturing the needed components in the U.S. would allow us to reduce imports and increase exports.

Appoint a Blue Ribbon Solutions Commission
A Blue Ribbon Panel of experts should be appointed and charged with developing a plan to make fast-track the shift to clean energy. While the President's BP Deepwater Horizon Oil Spill and Offshore Drilling Commission is not charged with recommending alternatives to offshore drilling, the impacts of the Deepwater Horizon clearly demand that we ask these questions and find a way to break our oil habit.

Senator WHITEHOUSE. Thank you very much, Ms. Savitz.

Thank you to all the witnesses for your testimony. There seems to be considerable agreement in certain areas, including even the same words being used by witnesses. The use of the dispersants being a grand experiment, with massive unknowns about its effect seems to be a common theme through all your testimony and suggests that there is both a need and a significant opportunity here for research. As long as we have done this, we might as well get out there and figure out exactly what the consequences are of it rather than simply let it happen without examining it.

Let me ask Dr. Kendall and Dr. Smith what resources you see for conducting this research. Is BP setting up funds that will support this research? Is it being done at taxpayer expense through EPA? Is it up to the scientific community to go about its usual business and try to find funding and pursue these questions? What do you see as the funding sources for the research that you recommend?

Mr. KENDALL. Senator, I would like to compliment you earlier this morning, exploring what we do know toxicologically about these dispersants, what is required to be approved. And in fact I agree with you totally.

I was thinking earlier that dispersants—we can be somewhat synonymous with pesticides, which are so heavily regulated. The pesticide industry has to provide considerable data to register a product and use it in the environment. They provide acute data and chronic data in environmental chemistry. And it goes through a scientific peer review process.

In fact they have to rebut the presumption of risk that that product will cause and effect in the environment.

Senator WHITEHOUSE. As I understand it, the dispersants only had to provide acute data, correct?

Mr. KENDALL. Exactly. So I look at the dispersants, and right now, very limited information to a point where we can't even evaluate the potential environmental toxicology. A laboratory experiment on maybe a shrimp and a fish doesn't help us understand much about the environmental chemistry and effects on other parts of the ecosystem.

In my opinion, and I support you totally as to your earlier questioning, I think we need to acquire more information and an appropriate regulatory process to find the best dispersants. And when we say they are approved, in fact we have environmental data and environmental toxicology data to say, this is in fact true. And we don't have to have a situation like we are dealing with now to have to backfill with data after we have used millions of gallons of it in the Gulf.

Senator WHITEHOUSE. Dr. Smith.

Mr. SMITH. Thank you. As far as the funding source, I think this should be a cost of business in extracting oil. I don't think it is a mystery that what type of oil, what type of crude oil is being extracted from there, and I find it very curious that we did not have these tests that were just done recently with this oil with the approved list of dispersants when we have known what type of oil that is. I think it is essential that the oil from the different areas be tested specifically for their consequences on organisms that are relevant to the area where it is being extracted, the type of oils being extracted and what are the proper dispersants.

Just looking at this particular data set that was just released on the 31st, as far as a dispersant, it looks like one other was much better at dispersing the oil if you look at the amount of the hydrocarbons that were retained in the water. And yet its toxicity was about the same.

So that should have been known beforehand. And maybe that decision could have been made to have that particular dispersant on hand.

Also, I think the testing has to be done in relevant conditions. The oil exiting the wellhead is very hot. It is estimated to be about 100 degrees or so, going into cold water. We don't have data on that, how it affects it at that level. And EPA is asking to minimize the amount of dispersant used, but it is not really stated what the goal is. Is the goal to disperse as much oil as possible, or is it to minimize the ecological effect?

So getting the right ratio of dispersant, the particular dispersant with the right type of oil that is being extracted, I think is critical. Like I say, I think that should be a cost of doing business.

Senator WHITEHOUSE. Let me ask generally, sort of a jump ball, you heard the testimony this morning, and you may very well be familiar with the testing that was done by the EPA that has been reported out fairly recently that compared the relative toxicity of the different dispersants and said that they were more or less of a par with each other, in some cases a little bit more for one species, a little bit less for another. But they were generally comparable.

You all are scientists, you have dedicated your lives to this kind of study. How complete and effective is that particular study as a point from which you could draw conclusions about the many different questions that you have said have been left or are unanswered at this point? And what else would need to be done to get a more authoritative determination on the questions that you believe we need to study?

Dr Smith first, then Dr. Overton.

Mr. SMITH. Thank you. One of the things that concerns me is that when these tests were done, they are short-term tests, acute toxicity, they don't address long-term effects and sub-lethal effects. I also am concerned that—particularly I focused on the application of dispersants at depth. The organisms that are used were chosen for a good reason in that they are commonly used for this purpose, and that allows you to compare different experiments. But they have no relevance whatsoever in the deep sea.

The fish that is used is a small estuarine fish. And the mysid at not at depth, either. So I would not extrapolate very far.

Senator WHITEHOUSE. Dr. Overton.

Mr. OVERTON. I would agree. I think when you are doing toxic testing, you have to use a standard series of testing. You can't try one thing and then slip around it to get any comparative data. So you have to pick a species. You should pick more than one, many species, but clearly we didn't have deep ocean and probably can't have, because they don't live at the surface, deep ocean species. So it is a real problem.

But having said that, the components in this dispersant biodegrade fairly rapidly. Now, that implies that the long-term impacts are minimal. Compounds that have heavy metals, compounds that have chlorocarbons that don't biodegrade, tend to bioaccumulated and have long-term impacts. Non-persistent compounds, petroleum, in fact, does degrade and degrades fairly rapidly.

My problem with all this tox testing is that oil changes so much from its input into the environment through its journey into the environment. Which point do you take to look at the efficacy testing? And even the tox, most of the time you take the most toxic part of the oil, that is the early fresh oil, as opposed to the weathered oil. But in some cases, where you have a really heavy crude, not in this spill, but in other spills like *Exxon Valdez*, that oil, the residual components may have significant toxicity.

So it is a complex question. But we have a great opportunity to study if there is going to be long-term impacts, these types of things, from this spill. Because we simply can't go out into our environment and release large quantities of oil.

Now, let me get back to the funding question. Mineral Management Service has generated royalty income to the Federal Government of billions of dollars. Virtually all of that money has been spent on not understanding the environment. A little bit of it has. The old Mineral Management Service had an environmental studies program.

But almost none of the money looked at deep ocean environments. Revenue stream is there to provide this funding. Now, it certainly should be part of the industry's—if you are going to take on a very difficult, risky procedure, you ought to know how to respond to it, and you ought to know what the impacts are.

But the Government ought to have some oversight. And taking some of that royalty money, a significant amount of that royalty money, and understanding how both from an engineering perspective as well as an ecological perspective what to do about it. We didn't even have really good techniques to collect samples at depth. Most of the sampling technology was to collect plankton and animals like that, not oil. So when these samplers went down to the depth, they got coated with oil and we never knew whether they were really getting a true sample or whether it was some of the oil that they had passed through.

It is incredibly complex. All of this stuff should have been developed. Also, BP has set aside something on the order of $500 million for understanding the long-term impacts. That is in addition to what NOAA's program is.

Senator WHITEHOUSE. And that gives me the opportunity to make a shameless plug for my National Endowment for the Oceans legislation, which would take some of these revenues and set them aside in a process that be both geographically based, so that local conditions could be addressed, and competitive, so that the more significant issues would be reviewed through a competitive grant process, could also be addressed. That is a bipartisan legislation with Senator Snowe. We are working very hard to try to get that incorporated into energy legislation as that moves forward.

So I appreciate your thoughts, Dr. Overton. We are very consistent on that.

Starting with Ms. Savitz, all of you are experienced scientists. You have heard the testimony, Dr. Overton, you have already said so yourself, that the bioaccumulation risk is low from, as I understand it, the dispersants, low from oil and low from the dispersant-oil combination. Is that something that everybody on the panel is comfortable with as an assessment?

Ms. Savitz.

Ms. SAVITZ. Yes, Senator. First of all, thank you very much for your legislation for the National Endowment for the Oceans. We support that and appreciate it.

Just to get back to your last question quickly, in terms of whether the EPA studies are enough to draw conclusions, I certainly agree with Drs. Smith and Overton that they are not. Part of the reason for that is they are so short-term. It is a 48- or 96-hour study. Even if all the dispersing goes away in that period of time, the animal doesn't die, that doesn't mean that it is going to survive and grow and flourish and be able to escape predators.

And of course it doesn't answer the question of whether that animal might have hatched in the first place if it was an egg when it was exposed or whether the larvae would have survived. And finally, it doesn't get to the whole ecosystem question and how is the ecosystem affected. But even if it is a short-term exposure, it can still have effects.

And your last question on bioaccumulation, it is my understanding that these chemicals are not expected to bioaccumulated. But I certainly would defer to my esteemed panelists.

Senator WHITEHOUSE. Dr. Overton, I think you have already said that. But if you want to just clarify.

Mr. OVERTON. We know oil, for example, the polycyclic aromatic hydrocarbons don't bioaccumulated. That is what people are looking for. Those are the toxic compounds. And we have enzyme systems in our bodies, as do the animals, that differentiate that. So I have never heard of a case where we actually saw in tissue bioaccumulation of these types of compounds, except when the fish was tainted; it swam through oil and there was oil on it, which is contamination. But that is not from a biologic process.

Having said that, it could be some other issues.

I will let Ron come in.

Mr. KENDALL. Thank you, Dr. Overton.

Senator, it is according to what kind of end points you want to look at. I agree with the bioaccumulation data. But many of these substances in oil are carcinogens. For instance, benzene. If benzene is released, and we are exposed. And also the polycyclic aromatic hydrocarbons. Yes, we do turn them over, an organism can metabolize them. But also an organism can metabolize them to be active as a carcinogen. In other words, able to form an adduct with DNA.

So that to me is a consequence of chronic concern. Maybe not bioaccumulation, but just because we don't have active bioaccumulation doesn't mean we don't have issues in a more chronic sense, in addition to the acute sense.

Senator WHITEHOUSE. Anything to add, Dr. Smith?

Mr. SMITH. No. I agree with both of them.

Senator WHITEHOUSE. Let me ask a slightly different question. The National Contingency Plan prohibits what are called sinking agents. It is my understanding that it is the nature of oil to float on water, that because of the effect of the dispersant, it is broken up into smaller particles that have less buoyancy and therefore stay in the water column longer, held down by thermoclines and currents and things like that. But that it remains inherently buoyant. And all things being equal, would ultimately come to the surface.

At the same time, as Dr. Overton has testified, there is this elusive quality to the oil as it weathers. Does a point come at which the oil sinks naturally? If there is not, or even if there is, is that process accelerated by the use of the dispersants with the conclusion reasonably to be drawn that there will be more sinking of the oil as a result of the use of the dispersants? And in light of the fact that sinking agents are forbidden under the National Contingency Plan, is that a concern that we should be looking out for?

Mr. OVERTON. Every oil spill has sinking issues associated with it. This is incredibly light oil; doesn't have much of the heavy ends that would cause the oil to sink. The only time it can really get heavy enough to stay beneath the water is when it is—in stages where it is weathering and washing up on the shoreline it gets mixed down in with the sediment and detritus. I have seen several pictures of this gunky material that is in the little wave rows that are under water.

Senator WHITEHOUSE. But that shouldn't happen in the deep sea, the attachment to detritus.

Mr. OVERTON. I have heard several reports of sunken oil. We have yet to get a sample. I asked just yesterday at a science meeting, has anybody gotten a sample of deep oil. And the answer was no. So I would be very surprised, not every case, but in this very light oil, remember, all oil is grossly different. So you have to handle each spill on a case by case basis.

Senator WHITEHOUSE. Dr. Kendall.

Mr. KENDALL. Senator, it is really complicated. With the deep water release you have a very challenged environment. It is dark, cold, less oxygen, less microbial activity. A lot of these issues are very complicated because we just don't have much data as related to the response of the dispersant-oil mixture in that kind of high pressure, cold environment. Much different than a laboratory acute toxicity test with a shrimp exposure.

So in that perspective, that is what makes this so challenging and why it does present itself an opportunity as we think about continued deep water drilling, perhaps we need more information as to the ultimate ramifications of release of oil into the deep water and how we are going to manage that. Because quite frankly we know very little about the behavior of the oil, even dispersed in the deep water, where it goes and how it travels in the currents.

Senator WHITEHOUSE. And in terms of the—well, I am told that there is some sense, perhaps even some observation and measurement that we are starting to see some of the oil dispersant mixture that is in the water column beginning to settle to the ocean floor. There it risks contaminating the benthic layer, which I don't know at that depth how rich an environment it is. But is the question of sinking oil, assuming that that proves out under observation, a particular concern that we should worry about? Or is that not something you would be concerned about?

Mr. KENDALL. At this point, I have not seen the evidence that is occurring enough to be worried about it. Although I have seen evidence that oil exiting the wellhead and being hit continuously with dispersant has created, as it comes to the surface, many different forms of oil. We have seen all the way from mats to a chocolatey mousse-like substances, some floating a little below the surface, sheens, tar balls. So we have seen a lot of different forms of oil, which I think ties back to the dispersant use.

So it is complex. I again don't have any data to support this sinking concept. As we look at this whole scenario, this is uncharted territory. We need science now.

Senator WHITEHOUSE. Closing words, I will let Dr. Overton say what he wishes. But I think the notion that these are uncharted waters, we need to make sure that we apply adequate science to it, and we really do not know yet what the long-term effects of this will be seem to be the themes that we can all agree with about where we stand right now on the dispersant use.

Dr. Overton, what did you want to say?

Mr. OVERTON. The glimmer of light in this darkness about deep sea oil is a lot of oil entering the Gulf naturally for the last millions of years, I have heard estimates of two *Exxon Valdez* size spills annually in the deep water environment. The Gulf is, of course, acclimated to do that. And the environment, actually these seeps turn out to be a pretty active community. The organisms evolve and live on it.

So there is so much unknown that it is mind boggling. But we do know that the Gulf is very active and alive with two *Exxon Valdez* size spills annually for the last millions of years. That is way outside my area of expertise.

But I do want to point out that it is not totally—I mean, I totally agree; we need a comprehensive understanding of the full impact. Because this is a massive, acute input. And a seep is a chronic input. Big, big, difference.

But there is oil in the deep oceans. And there is some evidence of what is going on. But clearly put some of that royalty money back to use, to a good use. Thank you.

Senator WHITEHOUSE. Understood. And I think another good closing word is a phrase that Ms. Savitz used, that we are continually asking our oceans to take one for the team. And it is getting to the point where, as majestic and immense as our oceans are, it is becoming time, as our species grows in size and environmental effect, to start thinking of ourselves as caretakers of our oceans and not just takers from our oceans.

Whether you go to the far northern oceans and see ice sheets that have been there since time immemorial receding, or to the tropic seas, where coral reefs are dying and bleaching, to in-close coasts, like Narragansett Bay, where mean winter water temperatures are up 4 degrees, your colleague, Dr. Perry Jeffries, Dr. Smith, refers to that as a full ecosystem shift.

So it creates dramatic changes. Our fishermen are not getting winter flounder any longer. They are getting scup. It is a whole new market for them. It is a whole new blow to the fishing economy.

Or to the far seas, where you see the garbage gyres in the Pacific. I think we are up to 400 dead zones now charted in our oceans. And a more persistent and chronic threat from acidification, as we become the most acidic ocean in 8,000 centuries.

The oceans have taken a lot for the team. And I appreciate all of your work in bringing science and advocacy to bear as we approach—if not reach—a tipping point where we can no longer simply be takers but must become caretakers. So your testimony has been very helpful. Your work is valued. And I appreciate that you took the trouble to come here today.

The hearing will be kept open for 2 weeks for my colleagues to submit any further questions for the witnesses that they may get answered in writing. And without further ado, we will be adjourned.

Thank you.

[Whereupon, at 12:22 p.m., the Committees were adjourned.]

[Additional statements submitted for the record follow:]

STATEMENT OF HON. BENJAMIN L. CARDIN,
U.S. SENATOR FROM THE STATE OF MARYLAND

I want to thank Chairman Boxer and Chairman Whitehouse for holding this critical hearing on dispersant use in response to the BP Deepwater Horizon oil spill.

On April 20 of this year, the BP Deepwater Horizon exploded and began this Nation's greatest manmade environmental disaster. This catastrophe claimed 11 lives and has left thousands of others in turmoil across the Gulf Coast region. Our hearts and prayers go out to the families of those who died in the BP Deepwater Horizon explosion and to the hardworking Americans whose jobs and ways of life are threatened.

As an oil slick spread across the Gulf, threatening damage to the $2.4 billion fisheries industry as well as wetlands, beaches, and shipping routes one thing became painfully clear—we know a lot more about how to drill an oil well than we know about how to stop one from spewing oil or how to clean up the mess.

We have all watched a series of science experiments—the top hats and the top kills—unfold on underwater seacams. We've studied the diagrams in the newspapers and looked to experts on TV to explain what's happening 5,000 feet below the surface of the sea. Our hopes and expectations have gone up and down like yoyos as some attempts failed, some worked a little bit, and finally the flow of oil may be stopped for good.

But it's not just in their efforts to cap the well that responders were forced to make decisions on the fly with too little information about what works and what doesn't.

Since the spill began, somewhere in the neighborhood of 1.8 million gallons of chemical dispersants were applied in the Gulf. These chemicals break the oil into smaller droplets. In that form it mixes and dilutes into the water column rather than floating on the surface in a big slick. The rationale we've been given is that damage to the organisms in the water column is a lesser evil than damage to the wetlands and the birds and fish that live and breed in them.

Sadly, there is shockingly little to back up those claims. The number of facts we possess about these chemicals is far outweighed by the number of unanswered questions. Here are just a few.

- We have only this past Monday begun to get answers about how toxic these chemicals are when mixed with oil.
- We do not know whether breaking the oil up makes it more or less available to fish and other marine animals.
- We do not know how to track or clean up the plumes of oil that the dispersants have helped push under the surface.
- We don't know what impact these plumes will have on the ecosystem and the food chain of the Gulf over the long-term.
- We have very little information about the effect of dispersants applied 5,000 feet below the sea as this was the first time it has ever been done.

The constant refrain we have heard is that dispersants present us with a trade-off: protecting the more environmentally sensitive wetlands and marshes and the species they nurture versus the subsurface water column. But with so little known about dispersants and their impact on the ecosystem as a whole, I don't know how responders could have effectively evaluated the risks and come to this judgment.

This Committee has reported an important bill that would guarantee funding to study and develop better response technologies, including more research into dispersants. I am a proud co-sponsor of Senator Lautenberg's Safe Dispersants Act which would require more rigorous testing before using dispersants in the future. These are important legislative responses to the disparity between drilling technology and response technology.

But while these efforts to look forward are important, we need to be sure that BP and its partners are held responsible for the damage dispersed oil will cause to the environment, much of which may not be evident until months or even years in the future.

The Water and Wildlife Subcommittee that I chair has begun oversight of the process for assessing and repairing damage to natural resources and for holding BP and its partners responsible to pay for it. As we seek to understand and document the damage that's been done to the Gulf, it is critical that the impacts of dispersants and dispersed oil are front and center. That is the only way we can be sure we will restore the health of the Gulf Coast region and a cherished way of life to its people.

STATEMENT OF HON. KIRSTEN GILLIBRAND, U.S. SENATOR FROM THE STATE OF NEW YORK

Thank you, Madam Chair.

Chairwoman Boxer and Chairman Whitehouse, thank you for holding this very important joint hearing as this Committee continues to investigate the BP oil spill disaster, and in particular the unprecedented use of dispersants and the potential immediate and long-term effects these chemicals may have on the environment.

I want to recognize our expert witnesses as well and look forward to receiving their testimony and analysis.

One hundred and seven days since the BP Deepwater Horizon platform exploded, killing 11 rig workers, nearly 2 million gallons of dispersant have been used in the Gulf of Mexico to fight the worst environmental disaster in our Nation's history. Over this time many questions have surfaced, highlighting the need to investigate the process used to test the safety and effectiveness of dispersants prior to their listing on the pre-approved National Contingency Plan—Product Schedule, as well as looking into long-term impacts that chemical dispersants may have on our marine and coastal habitats.

The answers to these questions are critical as we consider possible reforms to the process by which these chemicals are considered for emergency response. In addition, more information will aid evaluation of the environmental trade-offs between use of chemical dispersants versus natural biodegradation and other oil spill response tools, such as skimming and burning.

Madam Chair, on the heels of the release of EPA's Phase II testing this week, today's hearing will provide the Agency an opportunity to clarify what the results say about the immediate impacts of dispersants and what I believe is essential—differentiating between what we know and what we still don't know about chemical dispersants.

It is these long-term unknowns which I am most concerned about.

In the aftermath of the horrible tragedy of 9/11, thousands of first responders, clean up workers, and local residents were exposed to a host of chemicals and toxic substances in and around Ground Zero, and the long-term effects of that exposure have resulted in chronic illness and even death.

As we examine the response to this disaster and the processes and regulations that govern how these chemicals are approved and put to use, it is clear that much more data is necessary, and reforms to the regulatory system might be warranted—something I am hopeful this Committee will play an active role in.

Thank you again, Madam Chair and Chairman Whitehouse, for calling this hearing, and I look forward to our witnesses' testimony.

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