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August 4, 2010

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

U.S. Senate Committee on Environment and Public Works

One Hundred Eleventh Congress, Second Session

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Statement of Barbara Boxer
Hearing: UPDATED: Full Committee and Subcommittee on Oversight joint hearing entitled, "Oversight Hearing on the Use of Oil Dispersants in the Deepwater Horizon Oil Spill."
Wednesday, August 4, 2010

(Remarks as prepared for delivery)

This hearing is part of the Environment and Public Works Committee's oversight of the federal government 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 all together, 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 hopes of protecting the shoreline from oil slicks, it also raises 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 the dispersant 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 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, and what we have learned over the past three months since the start of the disaster in the Gulf. Just as important, they will speak to what we do not yet know about dispersants and 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, and more remains to be done.

Today's hearing is an important step in getting answers to the questions raised by this unprecedented disaster.

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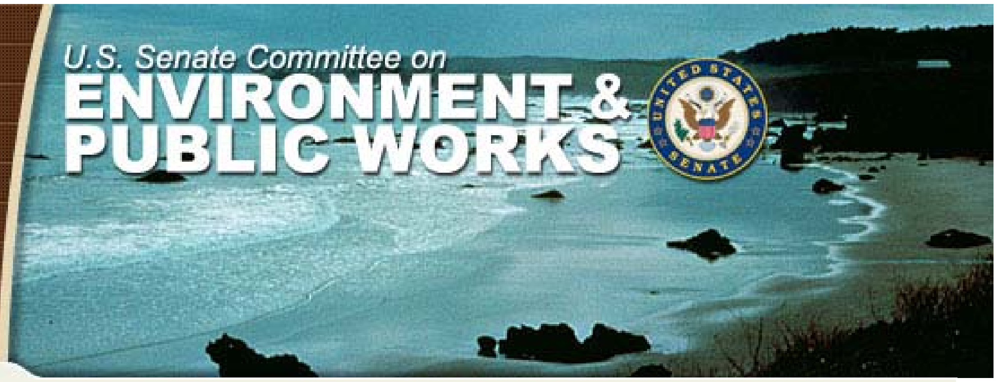

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Statement of James M. Inhofe
Hearing: UPDATED: Full Committee and Subcommittee on Oversight joint hearing entitled, "Oversight Hearing on the Use of Oil Dispersants in the Deepwater Horizon Oil Spill."
Wednesday, August 4, 2010

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 Sen. Lautenberg on bipartisan legislation if there's a need for it. Thank you.

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phone: 202-224-8832

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456 Dirksen Senate Office Bldg.Washington, DC 20510-6175
phone: 202-224-6176

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Statement of John Barrasso
Hearing: UPDATED: Full Committee and Subcommittee on Oversight joint hearing entitled, "Oversight Hearing on the Use of Oil Dispersants in the Deepwater Horizon Oil Spill."
Wednesday, August 4, 2010

Thank you Mr. Chairman,

The ecological fallout from the oil spill in the Gulf is not yet fully understood.

I'd like to thank the responders for their hard work in the gulf.

Responders in the Gulf were faced with a choice.

On one hand they could allow millions of gallons of oil to pollute beaches, marshes, and wetlands.

This would include the potential devastation of wildlife in these areas.

It would also include hurting jobs in the fishing and tourism industry, and the towns that depend on those industries to provide a tax base from which to pay for schools and 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.

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 EPA in 1994.

Responders knew the use of dispersants to address massive oil spills is a well documented practice.

So responders chose the latter.

I think they made the right choice.

But don't take my word for it.

In terms of the choice between using dispersants or allowing oil to devastate the Gulf's economy, beaches, and habitat, White House Press Secretary Robert Gibbs said it best – "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 a 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 this spill's impact."
According to Admiral Thad Allen of the U.S. Coast Guard – "a legitimate alternative" to the dispersant Corexit "has not surfaced yet."

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 twenty two, where 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 you even know how existing law is working makes no sense.

It would only serve to create more regulation, and slow the response to any future spills.

I thank the Chairman and look forward to testimony.

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phone: 202-224-8832

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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.

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.

"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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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.

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”.

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

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[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.