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

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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.