Testimony of Valerie Ann Lee
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Good morning Chairwoman Bordallo and Ranking Member, Mr. Brown, and members of the Committee. My name is Valerie Lee. I am the Sr. Vice President of Environment International Government Ltd (EIGov). EIGov is a service-disabled veteran-owned small business (SDVOSB) environmental consulting firm. The controlling service-disabled veterans are former Navy officers, one of whom is a decorated, combat-tested Vietnam Veteran Swift Boat Captain, Jack Burke, seated behind me. Mr. Burke and I first met professionally in 1986 many years ago working together as government attorneys on a very large oil spill in San Francisco Bay that resulted in one of the most successful injury assessments and restoration efforts still to this day. I am also the President of Environment International Ltd., a woman-owned sister company to EIGov.

Our focus at these companies is an interdisciplinary approach to science and law to address matters just like the Deep Water Horizon oil spill. We are group of cross-disciplinary trained experts – lawyers who are also scientists and engineers, economists who are also environmental engineers and the like.

We share a deep respect for the oceans and the marine environment with the members of this Subcommittee and the people of the Gulf Coast and we have a great love of science and law. The Principals of EIGov who have served our country and have a commitment to duty, honor and service are pleased to support me in my testimony today.

The Subcommittee has asked that I address:

1) The existing gaps in observation data needed to predict the extent and trajectory of the oil spill, including information about subsurface plumes;

2) The adequacy of pre- and post-impact spill data needed for conducting natural resource damages assessments;

3) Additional data required to understand the impact of the oil spill on the marine environment; and

4) Other information relevant to the Subcommittee's work and appropriate assessment of injury.

Before addressing these issues, I would like to provide the educational and experiential base that helps inform my answers to these questions.

I received my undergraduate degree in biology from Bates College in Maine, a masters in civil engineering from the Massachusetts Institute of Technology, where my focus was on water resources and my law degree from the Yale Law School. I am the primary author of the only treatise in existence on natural resource damage assessment, *the Natural Resource Damage Assessment Handbook: A Legal and Technical Analysis*, published by the Environmental Law Institute in Washington, D.C. This treatise is used by the government agencies and others to train NOAA personnel, US Fish and Wildlife personnel in natural resource damage assessment.

I have worked on natural resource damage matters in all years since 1986. I have provided advice to private parties and also all levels of government on natural resource damage assessment matters. I have assembled teams of experts from multiple disciplines on cutting edge science issues to identify information that should be collected to assess injury, analyze the data, and frame approaches that will restore it and value injury. We have dealt with some of the largest data sets in the world to address consider natural resource injuries from pollution and have worked on more than one what is called "mega-site" where potential injuries are spread across hundreds and hundreds of square miles and injuries are hidden from view in the subsurface environment – such volumes are huge. These subsurface environments have not been the deep ocean; they have been groundwater plumes, because quite frankly the world has never dealt with a deep water spill and injuries beginning a mile beneath the ocean surface.

I have conducted neutral reviews of oil spill contingency planning and response after Exxon Valdez and provided advice in connection with improvements that could have been made to integrate natural resource injury assessment with oil spill response.

I am expert in the law associated with natural resource damage assessment. While at the Department of Justice, working with Jack Burke our CEO, I filed some of the first natural resource damage lawsuits on behalf of the United States. I am fully aware of the law under the Oil Pollution Act, the Clean Water Act and other statutes that are relevant to the Deepwater Horizon Oil Spill.

With that as a backdrop, I would like to address the Subcommittee's questions on data to consider subsurface potential impacts, the data gaps and needs to conduct natural resource damage assessments, and the data to understand the impact of the Deep Horizon Oil Spill on the marine environment. I would also like to contribute insights on the current structure and procedures that are in place to respond to oil spills and conduct natural resource damage assessment.

The short answers to the Subcommittee's questions are that the resource needs are substantial and immediate. The data gaps are large. The amount of resources that have been brought to bear to consider the impacts of the oil spill in the marine environment, especially the subsurface environment are inadequate to the task at hand. The reason for this is not for lack of interest on the part of the agencies, NOAA and U.S. Fish and Wildlife Service; it is for lack of technical and human resources. The paucity of data is created by financial constraints. It also derives from the human frailty of us all, whether we are members of the public, work for government, or are employed by the private sector.

Humans are not well suited to understand the importance of what they cannot see and feel within their personal spheres, even if the threats are large and real. The world beneath the surface of the ocean is beyond our view. Its importance has not been recognized in the way that it should have been by *all of us*.

For these reasons, we are behind the curve in scientific knowledge of the ocean ecosystems and the species that live there and support our economy. The agencies tasked with studying natural resource injuries and restoring injuries when they happen do not have procedures and integrated approaches to address subsurface spills involving the deep-sea environment. We are playing catch-up. We are having on-the-job training in the worst of jobs, the Deep Horizon Oil Incident – an explosion that caused substantial loss of life and we send our condolences to those families for their loss – an explosion that has resulting in an ongoing spill of a growing spatial and volumetric magnitude that is hard to fathom, causing injury to our marine ecosystem and to entire coastal economy of a major part of the United States. Measured by environmental injury and economic losses, that we in the trade call lost human uses, this is the largest natural resource damage case that this country has ever seen and I hope the world will not see one again. Damages are in the billions.

We are off-page and out of the book. With an ongoing spill of this size and severity, the law fails us as a mechanism for truly meaningful reparation for the sea, the marine ecosystem and the species that are a part of it, and the Gulf Coast economy supported by it. The law cannot achieve a compensation to make the public truly whole. The fundamentals of science are the only real means to achieve an outcome for this spill and to ensure that others do not ever place our regional economies and ecosystems supported by them in danger.

As the Subcommittee has asked me to do, it is right to begin with data needs, data gaps, and how we fill them. Despite the spill's enormity and complexity, the fundamentals of science and logic guide us to an understanding necessary to build toward some type of restoration necessary for a healthy, vibrant Gulf Coast economy and a place where we and our children want to live, work and recreate.

To conduct an injury assessment for this spill and to develop information to help us restore at least some part of the natural resources on which the vibrant Gulf Coast economy depends, we need to assess the following.

- The transport and fate of the oil in the subsurface and surface regimes.
- The concentration of the contaminants in the subsurface from the oil being released over very large volumetric/spatial scales – currently one third of the gulf is closed to fishing.
- The toxicity of these contaminants delivered to organisms in the subsurface, e.g., fisheries, phyto- and zoo-plankton etc. and the toxicity at the surface to myriad species of the Gulf Coast ecosystem.
- An understanding of the physical effects of oil that can cause injury, such as breeding failure, or death.

- The location of species and whether or not they have been exposed to the contamination; the species of concern are not just the macro-charismatic ones, they are those at the bottom of the food chain that are not easily viewed, phyto-plankton, zoo-plankton and others. They are the ones that are exposed to toxicants at 3,000 feet and below as well as those higher in the water column.
- The consequences of ecosystem chaos precipitated by organisms "feeding" off the oil plumes and, thereby, likely to deplete oxygen in major regions of the subsurface.
- Information on injuries that have already occurred to mammals, birds and fish that are evidenced through bodies, not seen on the surface, but lying far below on the sea floor.

We have considered the cost to accomplish this work. Our estimate of the cost of an assessment to perform the foregoing might be surprising for some. It is *at least a billion dollars*. The reason why the number is so large is that it relates to the difficulty, expense, and time required to collect data with the current techniques in the deep-sea environment. Is it also driven by the enormity of the surface scale of known injury and the huge volumetric scale of the subsurface potential impacts that must be studied. We are limited in our ability to study such impacts. Among other things, there is:

- A rather rudimentary understanding of the deep sea and subsurface ecosystem as compared to the surface;
- A paucity of high resolution data on currents in the Gulf at different depths from 5,000 feet to the surface; this information is required to run numerical models that could offer mathematical predictions as to where the oil would go and also help us understand its transformation;
- A lack of a developed 3-dimensional (3-D) mathematical model that can be used to predict the transport and diffusion of oil spewing out of the deep, even with the collection of data above. Moreover, it may require the use of super computers to run such models;
- A lack of proven effective instruments for real-time measurement of contamination from oil in the subsurface, especially at depth;
- A lack of understanding of where the plumes are at depth and with what organisms the oil and dissolved phase toxic compounds from it are coming in contact;
- The effects of the oil and its constituents that have dissolved in water on organisms living in the subsurface;
- The cost of operating submersible vessels and surface vessels in sufficient numbers to allow collection of empirical data in sufficient quantity in subsurface space to be able to create information on currents, location of plumes, contaminant concentration, and exposures to organisms.

Given that we are behind on the knowledge and technology curve, this information base must be created for this spill to assess injury and to build toward at least a partial restoration of natural resource injuries. Many say that this is not possible; however, I believe with the right team of experts and appropriate amount of resources devoted to the issue we have hope for identification and restoration of injuries from this spill and we will create an information base for the next spill, if and when such an unfortunate event occurs.

The Gulf is dotted with rigs, some operating at thousands of feet below the surface; it would seem that the Congress may want to consider the costs of these assessments as properly assigned to the

companies operating in the Gulf. Indeed, much of this work should have been done to prepare realistic and technically sound environmental impact statements and it was not done. Instead, the government and the industry relied on the silver bullet of the "blowout preventer." In the case of the Deep Water Horizon, this silver bullet missed its mark.

The Nation now understands the importance of the Gulf; its importance to the organisms who support us and our economy; its importance to our children and their future. We now understand that we should have spent more financial resources on "inner space," the deep ocean, especially if we are to site hazardous activities like drilling that cannot be controlled and contained if the first line of defense goes awry. Appropriate risk management is to collect this information now, to ensure that we are prepared for a possible future failure. What follows are specifics of what we suggest as approaches to fill data gaps and meaningfully assess injuries. It also offers some possible improvements in government procedures in the aftermath of oil spills to ensure that we do not bring our economy to its knees as a result of spills.

1. Identification of subsurface plumes and contaminant concentrations; resource and data needs.

The only study we could find on consideration of a deep-sea spill was performed by the Mineral Management Service, ironically, in conjunction with BP and oil industry participants. I have attached these documents to my written testimony. With miniscule quantities of oil in that test release study by comparison to what we have with the Deep Horizon Oil Spill, the results suggested that we would find what we are seeing in the Deep Water Horizon spill. Plumes were created subsurface and the oil did not rise to the surface in a direct path. Napthalene, a constituent of oil that is highly toxic, was dissolved in water and delivered at depth to resources in the contaminant's path. This is but one of the toxic compounds in oil.

Existing current data in the Gulf is neither of the spatial resolution nor of the type that we need for accurate mathematical modeling plumes of the fate and transport of oil released at depths. Further, at depths below approximately 1500 feet there is no light, the environment is very cold, and the pressure is extremely high. Oil and gas at depth acts and is transformed in ways different from at the surface. We saw a dramatic illustration of this with the hydration problem that made the Top Hat solution to stop the spill of oil useless.

NOAA's numerical fate and transport models are excellent, but they were designed to predict fate and transport of plumes at the *surface.* Thus, using a model the existing numerical fate and transport models to predict where the plumes are from the Deep Horizon will go and in what concentration organisms will be dosed with toxicants is not as reliable as we would like. Given that people's lives and livelihoods in the Gulf Coast depends on science providing reliable guidance for the fate and transport and injury assessment, we must take a different approach than reliance on numeric fate and transport models.

The government must collect empirical data. The government must collect sufficient samples over large spatial scales (more than once) to be to able to rely on statistics to help us understand the magnitude and environmental severity of the plumes impact and the ecosystem chaos that they spawn by creating a food source for organisms that may deplete the oxygen in major areas of ocean. Vessels and equipment can be used to collect real time, physical information on currents, temperature and the like.

Similarly, we need to collect water samples and determine whether oil contamination is present.

I would like to underscore that governments often give short shrift to statistics because they do not understand the discipline, but data collection and application of statistics to abstract conclusions for larger scale regimes and are our best hope for the identification of plumes and the assessment of injuries from the Deep Horizon spill.

We are challenged in two ways with the collection of empirical data, even with well-designed sampling studies and effective use of statistics.

First, based on an exhaustive review of research vessels (surface and subsurface), NOAA, which operates vessels frequently in partnership with universities, does not have enough marine assets/vessels to perform the kind of broad-scale, organized study required. NOAA has on the order of a total of a dozen surface and subsurface major vessels combined in the Gulf area at the present time, with three or four large vessels having already collected some data. This size of the fleet in Gulf, even including vessels primarily operated by Universities is not big enough to collect data over the spatial and volumetric scale that encompass a third of the Gulf. Thus, Congress should work with the President, including units of the Navy, to consider how this fleet could be augmented quickly to collect data. The type of data collected should include high resolution, spatially targeted data on currents at various depths.

Second, assuming we augment the NOAA research/study fleet, we have additional technical challenges. Technologies that we should have for reliable real-time chemical concentration data collection at depth do not exist. The industry and the government is in the position of "making do" with technologies developed for other data objectives, such as, temperature and opacity (physical measurements) rather than chemical concentrations of the constituents of petroleum products to identify the existence of contamination in the subsurface that encompass enormous volumes (3-D spaces). Fluorimetry is a technique, that have received limited use for the detection of "oil" and it may not be effective. In addition, it cannot be used to provide information on contaminant concentrations, such as of naphthalene, in water. To consider contaminant concentrations gas chromatographs and mass spectrometers must be used. These are big instruments that are in the lab and not field measuring techniques.

As a result, NOAA has largely relied on using samplers lowered from a surface vessel to depth to collecting water samples. Such samples are raised to the surface on board ship. The ship needs to steam to port and then provide the samples to laboratories which will then take days to be analyzed. The net effect of this method is that *investigators do not know whether or not they are taking samples in the plume and, if so, do not have feedback to enable them to measure the vertical and horizontal extent of it while they are on location to sample.* They cannot find its boundaries. Thus, our ability to locate subsurface plumes and contamination is substantially compromised. The investigators are flying the plane without instruments and guessing which way they should go and whether they have found the airstrip on which to land, so to speak.

We would recommend that a significant effort be launched immediately to support surface vessels with the helicopter pickup and delivery of oil samples and set up shore-side laboratories to process samples as quickly as possible.

These are our principal recommendations for the identification of the plumes from the Deep Horizon that do exist at depth and to better understand the subsurface of the fate and transport of oil.

2. Data needs to assess injuries to natural resources: species and resources.

Scientists will usually say that there is not the kind of "baseline" data that they need to be confident in the assessment of natural resource injuries from oil spills. The Gulf Deep Horizon is this problem on steroids. By comparison to resources that we see on the surface, there is much less known about resources in the subsurface environment, especially resources of the deep-sea environment.

First, to assess injury we need to know species distribution and whether or not there has been exposure to oil. Second, we need to understand how species– fish, plankton, mammals, crustaceans etc. and their various life forms -- living at various depths in a water column that is a mile deep are affected by petroleum products. If we are looking at injury from a population perspective, we need to know numbers.

When decisions were made to move ahead with deep drilling, we collectively did not do the job that we should have. Further, the reality is that there is *never* perfect data. So to assess injury, we need to fill this gap, not completely, but with *reasonable* information to allow us to make decisions that will help restore what we can from the spill and protect our fisheries and other resources that are the keystone of the Gulf's economy and way of life. Our recommendations are as follows.

First, gridded transects of the area of likely plume activity and underneath the surface contamination should be conducted. Transects should be accomplished with submersibles just like those conducted with planes in overflights to identify species composition and distribution. We recommend that real-time videography be used. Both remote submersibles and those manned by scientists can be used. Transects should be designed to systematically cover the area at various depths.

Second, just as we do a beached bird survey and walk a beach to identify dead birds and allow statistical analysis and estimation of the total number of birds killed, so to we should follow a similar protocol in the areas of the worst contamination. Such transects should follow the bottom and, obviously must use lights at depths below 1500 feet.

Third, we need to immediately synthesize available information on toxicity to a variety of species. As strange as this may seem, NOAA and the US FWS have never collected a systematic and thorough compendium of known toxic effects for the various species. For years, this has been a data need for the entire natural resource damage programs of both agencies AND it is essential for this spill.

Fourth, after a quick review of existing information, the governments should launch shore-side toxicity studies for keystone species. It is without question that even with a scientific literature review, we have substantial data gaps. Illustrative of this is that the most information that I am aware of on the impacts of oil spills and petroleum products on fishery resources is on salmonids and there is by comparison very little information on other species. This also has been a data need for many years and its time has come with the potential collapse of the fishing industry in the Gulf.

3. Other recommendations to improve Natural Resource Damage Assessment in the marine environment

a. Better integration of NRDA to oil spill response.

We have long history of oil spill response in the United States. The Coast Guard and others have done

an excellent job. If there was a failing on the PREP exercises, experts who participate in them indicate that they are not aware of any deep-sea drill scenarios. This should change if we intend to continue to have deep-sea rigs.

Second, human safety and stopping the spill are the primary objectives, especially in the early days of the spill. The Incident Command System is focused nearly exclusively on this. Moreover, the Coast Guard culture is properly one of working with the Responsible Parties. NRDA is seen by some in the Coast Guard as punitive.

The Deep Water Horizon necessitates a reconsideration of this practice and way of dealing. We suggest that the Administration consider revisiting the procedures and protocols because with the Deep Horizon we have learned that a spill of this magnitude can threaten the regional economy and dramatically affect peoples' lives. It is a dramatic illustration of how humans really are interconnected to the natural resources -- the health of the natural resources is more than an "environmental issue," it is important to the economy and even our national security. Different policies probably would have meant that the resources required to investigate and mitigate impacts could have been activated sooner. Arguably, it might not have made a difference. But it is worthy of consideration by the Administration whether or not there should be a parallel emphasis in Incident Command System on NRDA.

b. NOAA and US FWS are not well equipped to deal with NRDA in the subsurface environment.

In over 20 years of working with oil spills, I am not aware of NOAA or US FWS focusing on the potential of a spill like this in the subsurface environment for NRDA. Further, the resources of the two agencies are too limited to address a situation of this magnitude. They are using contractor support, but both agencies are focusing more on the resources that we see on the shore or on the sea surface. Moreover, in the case of the US FWS, the staff is exceedingly small. This is not to say that staffs should be increased because to truly be ready for all types of possible injury and associated assessment methods would require employing a significant percentage of the experienced biological scientists in the U.S. We recommend that NOAA and the US FWS develop an established network of experts identified within the United States to draw on for matters like these.

Thank you for your time. I look forward to any questions you might have.