DEEPWATER DRILLING TECHNOLOGY, RESEARCH, AND DEVELOPMENT

HEARING

BEFORE THE

SUBCOMMITTEE ON ENERGY AND ENVIRONMENT

COMMITTEE ON SCIENCE AND TECHNOLOGY

HOUSE OF REPRESENTATIVES

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June 23, 2010

DEEPWATER DRILLING TECHNOLOGY, RESEARCH, AND DEVELOPMENT

WEDNESDAY, JUNE 23, 2010

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON ENERGY AND ENVIRONMENT
COMMITTEE ON SCIENCE AND TECHNOLOGY
Washington, DC.

The Subcommittee met, pursuant to call, at 10:03 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Brian Baird [Chairman of the Subcommittee] presiding.

BART GORDON, TENNESSEE
CHAIRMAN

RALPH M. HALL, TEXAS
RANKING MEMBER

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Subcommittee on Energy and Environment

Hearing on

Deepwater Drilling Technology, Research, and Development

Wednesday, June 23, 2010
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building

Witness List

Mr. James Pappas
Vice President
Technical Programs
Research Partnership to Secure Energy for America

Dr. Benton Baugh
President
Radoil, Inc.

Mr. Erik Milito
Group Director
Upstream and Industry Operations
American Petroleum Institute

Mr. Greg McCormack
Director
Petroleum Extension Service
University of Texas - Austin

HEARING CHARTER

COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON ENERGY AND ENVIRONMENT
U.S. HOUSE OF REPRESENTATIVES

Deepwater Drilling Technology, Research, and Development

WEDNESDAY, JUNE 23, 2010
10:00 A.M.–12:00 P.M.
2318 RAYBURN HOUSE OFFICE BUILDING

Purpose

The purpose of this hearing is to explore the technologies, standards, and practices for prevention and mitigation of oil spillage during deepwater oil and natural gas drilling operations; the role of government-sponsored technology development programs in advancing these technologies; and, in the wake of the Deepwater Horizon tragedy, how firms will assess risk as it relates to incident prevention and mitigation.

Witnesses

- Mr. James Pappas—*Vice President, Technical Programs, Research Partnership to Secure Energy for America (RPSEA)*. Mr. Pappas will discuss the unique technological challenges of oil and natural gas drilling in deepwater and ultra-deepwater, as well as the role of RPSEA in developing technologies to prevent and mitigate incidences.
- Dr. Benton Baugh—*President, Radoil, Inc*. Dr. Baugh will address the adequacy of existing systems for incident prevention and mitigation, as well as the need for technological advances and the processes for deploying new technologies in the field. Dr. Baugh is a member of the National Academy of Engineering and an Adjunct Professor at the University of Houston.
- Mr. Erik Milito—*Group Director, Upstream and Industry Operations, American Petroleum Institute*. Mr. Milito will address technical standards and best practices for deepwater drilling incident prevention and mitigation.
- Mr. Gregory McCormack—*Director, Petroleum Extension Service, University of Texas at Austin*. Mr. McCormack will address advances in worker training as well as health and environmental safety practices in the oil and natural gas drilling industry.

Background

BP Deepwater Horizon Incident and Blowout Preventers (BOP)

On April 20, 2010, an explosion and fire occurred on the Deepwater Horizon drilling rig in the Gulf of Mexico. The rig, owned by Transocean and leased by BP, was in the final stages of drilling an exploratory well at the Macondo prospect in BP-operated Mississippi Canyon Block 252, and had achieved a depth of approximately 18,360 feet in 5,000 feet of water. The accident resulted in the death of eleven workers, a massive release of oil into the Gulf, and a national response effort by Federal and state government agencies as well as BP. Oil continues to flow from the well at an estimated rate of up to 60,000 barrels per day, and will likely continue at this rate until two relief wells are completed in August. While an investigation into the exact cause of the Deepwater Horizon accident is ongoing, it is understood to be a confluence of critical human errors and the failure of certain wellhead equipment designed to stop an incident. Through this hearing the Committee seeks to better understand the possible improvements in technologies to prevent and mitigate accidents during drilling operations, and the appropriate role of government-sponsored technology development programs in advancing these technologies and other methods to ensure safety.

At the Macondo well, initial investigations indicate that the primary technology failure lay in the Blowout Preventer (BOP), which is a large mechanism that in-

cludes a series of high pressure hydraulic valves designed to stop an uncontrolled flow of oil and gas from the wellbore. The Deepwater Horizon's BOP included elements of three different types of valves, or "rams." One type, known as a pipe ram, stops flow by sealing around the tubular components of a well. Another is a "blind ram," which closes over an open wellbore that does not contain pipe. The final line of defense, and likely the most critical failure in the Macondo accident, is the "blind shear ram," which uses two blades to cut through the metal drill pipe and seal the wellbore.

A BOP can be activated either remotely by personnel from the rig via electrical signal, automatically via a "deadman switch" in the case of a catastrophic incident in which the rig becomes disconnected from the BOP or a signal cannot otherwise be activated by personnel, via acoustic signal from a vessel other than the drill rig, or manually by remotely-operated vehicles (ROV). Crew members aboard the Deepwater Horizon attempted unsuccessfully to activate the BOP, including the blind shear ram, before the fire forced an evacuation. Furthermore, the automatic deadman switch did not appear to activate the BOP, nor was it equipped with an acoustically-activated switch. A number of subsequent attempts to activate the BOP using an ROV also failed. Gamma ray imaging of the BOP—devised by the Department of Energy for this incident—indicates that one of the two blades of the blind shear ram activated, but it is otherwise unknown when and how this occurred.

Several factors may have led to the failure of this BOP, but it appears that a leak in a "shutter valve" caused a catastrophic and irreparable loss of hydraulic pressure that rendered the blind shear rams too weak to cut through the drill pipe and seal the wellbore. It is not clear whether this leak happened before or after the blowout. However, even under normal operating conditions, the strength and reliability of blind shear rams have repeatedly been called into question by a number of studies and tests conducted in the last decade. In fact, some tests have concluded that the blind shear rams could only be counted on to fully activate approximately half of the time.

Cutting through hollow drill pipe requires several thousand pounds per square inch of pressure from each of the two blades. However, up to one-tenth of the length of the drill string is made up of more solid joints that connect the drill pipes, and these joints are virtually impossible to cut with blind shear rams that currently are designed to cut only through hollow drill pipe. This is compounded by the apparent fragility of the hydraulic system, and possibly the effects of deep ocean pressures and temperatures, which can weaken the force the hydraulic system can apply and increase the resiliency of pipes. Some operators in the Gulf have opted to increase the reliability of their BOPs by including two blind shear rams in case one fails, yet two-thirds of the rigs operating in the Gulf still have only one blind sheer ram. Still, many others both inside and outside of the industry, including the CEO of BP, have concluded that the design of blowout preventers must be rethought altogether.

Deepwater and Ultra-deepwater Drilling Technologies

Completed in 2001 in South Korea by Hyundai Heavy Industries, the Deepwater Horizon was a semi-submersible ultra-deepwater mobile offshore drilling unit (MODU) capable of operating in harsh surface conditions and water depths up to 10,000 feet with a crew of approximately 135 personnel. It was a dynamically-positioned vessel, meaning that it was not moored to any fixed point, but instead maintained its position above the well using multiple propellers and thrusters. Though state of the art when introduced, by 2010 the rig was one of approximately 200 deepwater rigs capable of drilling in greater than 5000 feet of water, and some are drilling at depths greater than 10,000 feet. In 2009 the Deepwater Horizon set the record for the deepest oil well in history by drilling to a depth of 35,000 feet.

Often likened to space exploration in its complexity, deepwater and ultra-deepwater drilling presents a unique set of technological challenges, including for safety and incident prevention and mitigation. For instance, the greater the depth of water, the longer the drill string must be suspended without support from the rig, and the more important it then becomes for a rig to maintain its position above the well. Deviations can put considerable strain on equipment, causing failure or even a disconnection of the rig from the subsea (seafloor) architecture. This is made all the more difficult for a rig floating in open ocean that must endure high swells, high winds and strong currents. Consequently, the drill string must be considerably thicker and stronger for deeper wells, and thus requires larger BOPs with much higher pressure rams to shear the drill string. Greater depths also add significantly to the weight of the fluid column in the drill string, and thus add greater bottom hole pressure and require more energy to lift drilling fluids and other materials from the well. Furthermore, because of the tremendous overburden, the hydrocarbon

reservoir may be under intense pressures far beyond those encountered in more conventional operations.

To overcome some of these challenges, deepwater drilling operations utilize subsea installations to conduct a range of functions that would otherwise be done at the surface. Such equipment must be robust enough to operate under the extreme pressures and temperatures which can cause everything from hydraulic equipment to the hydrocarbons to behave differently. Because of the high cost of testing technologies in the field, the industry is increasingly reliant on simulations and modeling to predict the performance and failure of equipment at depth. However, the extreme conditions of deepwater drilling are impossible to fully replicate in a lab.

The industry has devoted billions of dollars to researching and developing technologies for subsea and surface facilities specific to deepwater and ultra-deepwater drilling, especially those technologies which represent an increase in production efficiency. However, many contend that the industry has not devoted similar resources to the development of technologies and methods for accident prevention and mitigation. If there is a critical technology gap, the question remains as to the appropriate role of government-sponsored programs in assisting industry in developing more reliable technologies, overseeing their deployment, ensuring the development of more robust industry standards, and disseminating best practices.

Department of Energy Programs

The Office of Oil and Natural Gas, in the Department of Energy's Office of Fossil Energy, supports research and policy options to ensure clean, reliable, and affordable supplies of oil and natural gas for American consumers. However, funding for this program in recent years has been relatively limited, resulting in few initiatives to develop technologies to avoid and mitigate incidences such as the Deepwater Horizon accident. From fiscal years 2007 through 2011, both the Bush and Obama administrations have made no request for funding of any oil technology research. However. Congress has continued to appropriate small amounts solely towards exploration and production technologies. The last appropriation to the Office of Fossil Energy's Petroleum—Oil Technology program was in 2009 for just under $5 million.

Under section 965 of the Energy Policy Act of 2005, DOE has the authority to conduct research and development in oil and gas exploration and production as well as related environmental research. DOE has a wide range of intellectual and technical resources, including the national labs, that could be leveraged to conduct research and advance technologies in areas that individual companies alone are not likely to aggressively pursue.

DOE also funds oil and gas R&D through authorization of $50 million in annual mandatory spending from offshore oil and gas royalty revenues collected by MMS. Through authorization in Section 999 of the Energy Policy Act of 2005, DOE conducts approximately $12.5 million of "in-house" research at the National Energy Technology Laboratory (NETL). The remaining $37.5 million in R&D is managed by a public-private research consortium.

EPAct 2005, Section 999—Ultra-deepwater R&D and the Research Partnership to Secure Energy for America (RPSEA)

Section 999 of the Energy Policy Act of 2005 authorizes the Secretary of Energy to establish an ultra-deepwater and unconventional onshore resources research and development program. Management of the program was awarded to a research consortium headquartered in Sugar Land, Texas, known as the Research Partnership to Secure Energy for America, or RPSEA, which is overseen for DOE by the National Energy Technology Laboratory (NETL).

The program under RPSEA is divided into three parts: ultra-deepwater architecture and technology (UDW); unconventional onshore natural gas and other resources; and technology challenges of small producers.

According to RPSEA, and consistent with EPAct 2005, the mission of the Ultra-Deepwater Program is to identify and develop economically viable (full life cycle) acceptable risk technologies, architectures, and methods for exploration, drilling, and production of hydrocarbons in formations under ultra-deepwater, or in the Outer Continental Shelf (OCS) in formations that are deeper than 15,000 feet.

This mission of technology development encompasses:

- Extending basic scientific understanding of the various processes and phenomena that directly impact the design and reliable operation of an ultra-deepwater production system.
- Developing "enabling" technologies that facilitate the development of additional technical advances.

- Enhancing existing technologies to help lower overall cost and risks.
- Pursuing "Grand Challenges" (long-term, high-risk research on applied science and on key leveraging and transformational technologies capable of "leapfrogging" over conventional pathways).
- Accomplishing ultra-deepwater resource development in a safe and environmentally responsible manner.
- The goals of the UDW are to develop the ultra-deepwater resource base and to convert currently identified (discovered) resources into economic recoverable (proven) reserves, while protecting the environment.

These goals will be achieved by:

- Reducing the costs to find, develop, and produce such resources.
- Increasing the efficiency of exploration for such resources.
- Increasing production volumes, production efficiency, and ultimate recovery of such resources.
- Improving safety and environmental performance, by minimizing environmental impacts associated with exploration and production in ultra-deepwater.

Since the inception of the program both the Bush and Obama administrations have sought to repeal funding of the Section 999 program. However, Congress has kept the funding mechanism and the program in place. RPSEA currently has approximately 170 members, with representation from across industry, academia, NGOs, and government laboratories and programs. In the wake of the Deepwater Horizon tragedy, questions have arisen as to how this program, in conjunction with a more robust program in DOE Fossil Energy, could better serve the nation's needs for development of advanced environmental and worker safety technologies and practices while providing a Federal resource for technical expertise on deepwater and ultra-deepwater drilling technologies.

Industry Standards and Best Practices

The Department of the Interior's Minerals and Management Service (MMS) is responsible for the promulgation of the nation's offshore operating regulations. According to MMS, the regulations are written to ensure "safe operations and preservation of the environment, while balancing the Nation's needs for energy development." These regulations are often informed by industry standards developed by the industry through the American Petroleum Institute (API). API is the main U.S. trade association for the oil and natural gas industry and is also the main body responsible for the establishment of industry standards. API issues standards that fall into two categories: manufacturing specifications and recommended practices. API's standard-making procedure is approved by the American National Standards Institute (ANSI) and convenes experts from manufacturers, drilling companies, operators, service providers, government regulators, and academia. Standards are also developed by other organizations such as the International Association of Drilling Contractors (IADC). MMS rules and regulations often incorporate these third-party organizations' standards which, when published in the Federal Register, have the "force and effect" of law. There is growing support for MMS to transition from broader, industry-written performance goals to narrower, more prescriptive regulations.

Chairman BAIRD. Good morning, everyone. Thank you for being here. Our hearing today will now come to order.

I want to begin actually by speaking on a topic not particularly germane, and that is to acknowledge the tremendous contribution of the Ranking Member of this Committee, of our Subcommittee. That is Mr. Inglis, who is a dear friend, a respected colleague, who can't be with us today. He had an election yesterday, and from this Member of Congress's perspective, it was a remarkably unfortunate result. He is an outstanding human being, a great asset to this Committee and to the country, and I appreciate deeply his many years of service.

I also should note that we have been informed that the Administration witness who we had hoped to join us today will be unable to participate, but we have received assurance that he or another member of the Administration will come and talk to us about this very issue at some future date. Given all they are dealing with down in the Gulf, we certainly can understand that and look forward to that testimony at some point in the future.

Mr. EHLERS. Mr. Chairman.

Chairman BAIRD. Yes, sir, Mr. Ehlers.

Mr. EHLERS. I would like to join you in your accolades of Mr. Inglis. He is—I served with him both times he was in the Congress, and after his hiatus and he returned, he was a different person. He is very, very dedicated to this country and also to preserving its environment, but in a reasonable, sensible way, and I think he provided a lot of good leadership on this committee in his very quiet and subtle way. Our Congress is the worse for not having him around in the future. So thank you.

Chairman BAIRD. I thank you, and obviously share that remark and very much appreciate it. Bob, by the way, is not dead. He is just—there was an unfortunate outcome and perhaps will have a better life for it. At any rate, he has just been a great Member of the Committee and he will be missed.

So today's hearing is——

Mr. HALL. Mr. Chairman.

Chairman BAIRD. Mr. Hall.

Mr. HALL. They may not know it, he was voted back to private life.

Chairman BAIRD. That is a nice way to say it.

Mr. HALL. He didn't pass away.

Chairman BAIRD. That is right.

Our hearing today is to discuss technologies, standards and practices to ensure safer deepwater and ultra-deepwater drilling. A wide range of technological innovations have allowed the industry to venture into ever-deeper waters to access the massive reserves of oil and gas found there. Admittedly, the payoff of pushing the technology envelope is enormous, and for the foreseeable future we are likely to be relying on fossil fuels, though I hope we will gradually and as soon as possibly reduce that reliance for a host of reasons.

But the Deepwater Horizon tragedy proved that, in the high-stakes game, poor judgment and faulty equipment can bring unimaginable consequences. It is precisely because this incident oc-

curred in 5,000 feet of water that we are discussing an ongoing spill 64 days after it began.

Committee staff and I just returned from visiting the Deepwater Horizon response efforts in the Gulf, and I want to pay my respects to the people down there who are working so hard. They are working 24/7 in extremely difficult conditions. We spent two days doing flyovers, on the ground, on the water, and met with them. I asked a group of folks in an integrated command system what can we do to help, and the first thing they said was interesting. They looked at me like I was from Mars and they said, "Are you serious? Because we are not used to politicians asking how they can help. Usually what you do is get off an airplane, make a bunch of critical comments and get back on the airplane." And they said the single most important thing we can do is to tell the public about the good work that is being done, and not in any way minimize the enormity of the spill or the loss of human life or the consequences for the environment, but that people are doing all they can. Every branch of government virtually is represented down there. All branches of the uniformed services are there with their assets, a total of 30,000-plus people. It is 100-plus degrees out there and they are working very, very hard in dangerous conditions with shifting weather and a challenging and unpredictable adversary in the form of the oil. They are doing some really remarkable work in what is the largest recovery and restoration effort in the history of humankind, and they deserve our admiration and respect and appreciation, and it is time, I think, for all of us in Congress to get past the blame game.

We need to understand it, but the goal really is to try to solve the problem for the future. And that is the purpose of this hearing, and I think it is important to say that it is not only the Federal agencies—and we met with NOAA, NIMS, Coast Guard, EPA, MMS—but also BP has got a lot of folks down there, and they are working hard and doing a good job, and I am proud to say a lot of folks from many of our states are there. I met Texans, I met Washingtonians, I met Michiganders and people from the DC area. Everybody, every state in this country, has got people down there working, and they deserve our appreciation. My personal goal is that at some point soon, if they are still insisting on having the spill image up, right beside that image is an image of the recovery and restoration efforts, because those deserve equal credit and that is where the real human beings are working really hard on the surface of the water and on the shores.

Having said that, our charge today, however, is to understand the technological advances and best practices to ensure that drilling in the deepwater can be done, if it is to be done, with minimal risk to workers and the environment. Operating safely in such extreme environments entails immense engineering and technological challenges, the complexity of which is encountered in few other human endeavors.

The technological expertise for drilling at these depths appears to reside almost solely right now with the private sector, and in the hyper-competitive field of energy, the industry is rightfully guarded about sharing information and collaborating on proprietary technology development. But safety interests are universal, and we lost

11 lives in this instance. We must now ask ourselves if the Deepwater Horizon tragedy calls for us to reevaluate the government's role in the development of accident prevention and mitigation technologies and in industry best practices.

And I would assert here, as well, that I would hope shareholders will pay attention to this. Instead of just asking what our return on investment is and what the latest reservoir is, I hope shareholders will start asking, is it consequential to our market value if we have a spill? And the people of BP have learned that the hard way, but it is rare that the shareholders look at the quarterly reports with a careful eye to what is being done on safety and accident prevention. I hope they will start, and that corporate boards will be a lot more attentive to that. It should not be the sole responsibility of the Congress.

So our goal today is to shed light on these important questions.

[The prepared statement of Chairman Baird follows:]

PREPARED STATEMENT OF CHAIRMAN BRIAN BAIRD

I want to welcome everyone to today's hearing to discuss technologies, standards, and practices to ensure safer deepwater and ultra-deepwater drilling. A wide range of technological innovations have allowed the industry to venture into ever deeper waters to produce the massive reserves of oil and gas found there. Admittedly, the payoff of pushing the technology envelope is enormous, and for the foreseeable future the world will be highly-reliant on these fossil fuels.

But the Deepwater Horizon tragedy proved that, in this high-stakes game, poor judgment and faulty equipment can bring unimaginable consequences. It is precisely because this incident occurred in 5,000 feet of water that we are discussing an ongoing oil spill 64 days after it began.

Committee staff and I just returned from visiting the Deepwater Horizon response efforts in the Gulf. While the coordination and scale of the Federal effort is truly impressive and should be commended, witnessing it firsthand only strengthened my resolve to ensure that we never find ourselves in this situation again.

Whether the moratorium on drilling activities in the Gulf is lifted in 30 days or 30 years, we must accept that the hydrocarbon reserves in these fields will be produced someday. And if not there, it will certainly be done somewhere else in the world. Our charge is to understand the technological advances and best practices to further ensure that drilling in the deepwater can be done with minimal risk to workers and the environment.

For good reason, drilling at these depths is often compared to space exploration. Operating safely in such extreme environments entails immense engineering and technological challenges, the complexity of which is encountered in few other human endeavors.

However, unlike space exploration, the technological expertise for drilling at these depths appears to reside almost solely within the private sector. In the hyper-competitive field of energy, the industry is rightfully guarded about sharing information and collaborating on proprietary technology development. But safety is universal. We must now ask ourselves if the Deepwater Horizon tragedy calls for us to reevaluate the government role in the development of accident prevention and mitigation technologies and industry best practices.

At the least, we must identify the critical gaps in safety technology and practices, identify the resources already in place in government-sponsored research programs and laboratories, and push to coordinate these resources to meet both the needs of the taxpayers and the safety requirements of the industry. It's time we push the technological envelope of environmental and worker safety in offshore operations.

My goal is to shed light on these important questions through today's hearing.

Chairman BAIRD. With that, I yield to our distinguished Ranking Member of the Full Committee, Mr. Hall, my friend from Texas.

Mr. HALL. Thank you, Mr. Chairman, for holding the Committee hearing, and as the response effort on the Gulf enters its third month, we are beginning to get, I guess, a more clear picture of what went wrong in the Deepwater Horizon and what needs to be

done to make sure it doesn't happen again. I hope and expect the S&T Committee to play an important role in this effort, particularly as we inform and contribute to the legislation package that the House will pursue in July. This package may seek to address and provide guidance on whether or not a short-term or a permanent moratorium on deepwater drilling is necessary.

As is evidenced by yesterday's granting of injunctive relief by the United States District Court for the Eastern District of Louisiana suspending enforcement of the Administration's 6-month moratorium, more time is needed to craft a reasoned and measured response and solution to this incident and to others like it.

It is important to remember that prior preparation and understanding provide the best foundation for long-term solutions. The economic impact of the moratorium would be deep and lasting. Thousands of people have lost their jobs already. An estimated 40,000 additional jobs hang in the balance as the uncertainty associated with the moratorium remains unsettled.

Beyond jobs, the moratorium would also introduce a significant new environmental risk. The enormous global demand for drilling rigs would be likely to result in their departure from the Gulf to other countries, increasing U.S. dependence on imported oil and on oil tankers which are much more prone to spills than undersea pipelines. The moratorium would also drive skilled workers off the rigs and onto the onshore jobs, meaning that a high percentage of new, less experienced will be responsible for operations when drilling resumes. These events related to the moratorium would appear to increase, not decrease, environmental risk while inflicting economic damage on the people of the Gulf that would rival, if not surpass, that caused by the spill itself.

I hope that today's hearing will be informative in this regard, and I am pleased that we have some of the world's leading drilling technology experts before us. I hope the witnesses can help the Committee better understand the contributing factors to the Deepwater Horizon disaster, particularly as it relates to the soundness of the drilling technology itself versus the practices governing its use and its application.

The evidence gathered thus far indicates that technology concerns may not have been at issue. Rather, it seems a failure to follow industry-wide best practices created an environment ripe for a blowout. If this is indeed the case, it is my hope that these procedural shortcomings can and will be quickly addressed. I have heard from experts in the well intervention and oil spill containment fields that state-of-the-art technology currently exists in the form of state-of-the-art vessels and systems designed to respond to such situations and now finally being used to contain the BP spill itself. In discussions with these experts, it has been noted that a missing piece of an effective oil spill policy is planning for containment. I am interested in hearing more about how these technologies can be incorporated into the process so effective for planning and containment becomes the norm.

Regardless of the ultimate causes and best responses to the disaster, it makes sense to continue pursuing improvements to deepwater drilling, architectures and systems which will only increase its safety. In 2005, I helped create a program to do just that at the

Department of Energy known as the Super 999, or Ultra Deep program. It supports cutting-edge technology through a collaborative effort between DOE and industry into safe and environmentally responsible offshore and onshore oil and gas development. This program has been a success. Its contributions to deepwater drilling technologies are helping us recover energy supplies that we knew existed but were unable to access. This has returned significant benefit to taxpayers in the form of domestic jobs and affordable energy as well as increasing royalties to the fund that pays for the program in the first place. And unfortunately and despite the program's strong record of support in Congress, the Administration has repeatedly—both Administrations, Republicans and Democrats, have repeatedly called for its termination and it has also zeroed out funding for oil and gas R&D within the fossil energy program at DOE.

I think this represents a clear misprioritization and I hope the Administration will reconsider its position in light of the section 999 program's potential to advance safe and environmentally responsible drilling. Unfortunately, the Administration inexplicably backed out of this commitment to testify before our Committee at the last minute, so we won't get a chance to discuss the position on section 999 today.

I thank the witnesses who kept their commitments for appearing before us today, and I realize that you are very busy, very valuable hours to spend and that you give up something to come before us because we rely on you to tell us what is best for the greatest good of the greatest number of this country and we know that you are making a contribution to us, and I appreciate you being here and appearing before us today, and I look forward to the testimony and discussion, Mr. Chairman, to a good chairman, I yield back whatever time I have.

[The prepared statement of Mr. Hall follows:]

PREPARED STATEMENT OF REPRESENTATIVE RALPH M. HALL

Mr. Chairman, thank you for holding this hearing today on deepwater drilling technology, research, and development.

As the response effort in the Gulf enters its third month, we are beginning to get a clearer picture of what went wrong on the *Deepwater Horizon*, and what needs to be done to make sure it doesn't happen again.

I hope and expect the S&T Committee to play an important role in this effort, particularly as we inform and contribute to the legislative package that the House will pursue in July.

This package may seek to address and provide guidance on whether or not a short term or permanent moratorium on deepwater drilling is necessary. As is evidenced by yesterday's granting of injunctive relief by the United States District Court for the Eastern District of Louisiana, suspending the enforcement of the Administration's 6 month moratorium, more time is needed to craft a reasoned and measured response and solution to this incident and others like it. It's important to remember that prior preparation and understanding provide the best foundation for long term solutions.

The economic impact of the moratorium would be deep and lasting. Thousands of people have lost their jobs already, and an estimated 40,000 additional jobs hang in the balance as the uncertainty associated with the moratorium remains unsettled.

Beyond jobs, the moratorium would also introduce significant new environmental risks. The enormous global demand for drilling rigs would be likely to result in their departure from the Gulf to other countries, increasing U.S. dependence on imported oil—and on oil tankers, which are much more prone to spills than undersea pipelines.

The moratorium would also drive skilled workers off of the rigs and into onshore jobs, meaning that a high percentage of new, less experienced workers will be responsible for operations when drilling resumes.

These events related to the moratorium would appear to *increase*, not decrease, environmental risks, while inflicting economic damage on the people of the Gulf that would rival—if not surpass—that caused by the spill itself.

I hope that today's hearing will be informative in this regard, and I am pleased that we have some of the world's leading drilling technology experts before us. I hope the witnesses can help the Committee better understand the contributing factors to the *Deepwater Horizon* disaster, particularly as it relates to the soundness of the drilling technology itself, versus the practices governing its use and application.

The evidence gathered thus far indicates that technology concerns may not have been at issue; rather, it seems a failure to follow industry wide best practices created an environment ripe for a blowout. If this is indeed the case, it is my hope that these procedural shortcomings can and will be quickly addressed. I have heard from experts in the well intervention and oil spill containment fields that state of the art technology currently exists in the form of state of the art vessels and systems designed to respond to such situations, and now finally being used to contain the BP spill. In discussions with these experts it has been noted that a missing piece of effective oil spill policy is planning for containment. I am interested in hearing more about how these technologies can be incorporated into the process so effective planning for containment becomes the norm.

Regardless of the ultimate causes of and best responses to the disaster, it makes sense to continue pursuing improvements to deepwater drilling architectures and systems, which will only increase its safety.

In 2005, I led creation of a program to do just that at the Department of Energy. Known as the "Section 999" or "Ultra-Deep" program, it supports cutting-edge technology through a collaborative effort between DOE and industry into safe and environmentally responsible offshore and onshore oil and gas development.

The program has been a success—its contributions to deepwater drilling technologies are helping us recover energy supplies that we knew existed but were unable to access. This has returned significant benefits to taxpayers in the form of domestic jobs and affordable energy, as well as increasing royalties to the fund that pays for the program in the first place.

Unfortunately, and despite the program's strong record of support in Congress, the Administration has repeatedly called for its termination, and also zeroed out funding for oil and gas R&D within the fossil energy program at DOE.

I think this represents a clear mis-prioritization, and I hope the Administration will reconsider its position in light of the Section 999 program's potential to advance safe and environmentally responsible drilling.

Unfortunately, the Administration inexplicably backed out of its commitment to testify before our committee at the last minute, so we won't get a chance to discuss its position on Section 999 today.

I thank the witnesses that kept their commitments for appearing before us today, and I look forward to the testimony and discussion.

I yield back.

Chairman BAIRD. Thank you very much, Mr. Hall. I acknowledge the presence also of the Full Committee chair, Mr. Gordon, who has been a champion of safety and environmental protection and development of technologies. I understand Mr. Gordon has no opening comments to make, but thank you for being here, Mr. Chairman.

We all know, my colleagues know well if there are other members who wish to submit opening statements, those will be added to the record at this point.

[The prepared statement of Mr. Costello follows:]

PREPARED STATEMENT OF REPRESENTATIVE JERRY F. COSTELLO

Good Morning. Thank you, Mr. Chairman, for holding today's hearing to discuss technologies, standards, and practices to prevent oil spills in deepwater and ultra-deepwater drilling operations.

The explosion of the Deepwater Horizon oil rig in April 2010 has resulted in the largest oil spill in U.S. history and an environmental and economic disaster for the

Gulf Coast region. Following the disaster, President Obama declared a moratorium on deepwater drilling in the Gulf until the government and oil companies understand what happened on Deepwater Horizon and how it can be prevented. If the President lifts this moratorium and allows for deepwater drilling to go forward, we must ensure drilling mechanisms are tested and safe in deepwater. Further, as we develop new practices and technologies for deepwater drilling in the future, we must invest in research and development of safe and efficient drilling techniques.

First, it is imperative that the Federal Government and private industry inspect and test new technology before deploying it in deepwater drilling operations. Under the Bush administration, there were no requirements for companies to test and certify equipment and technology before beginning to drill. Further, neither the Bush nor the Obama administration requested any funding for programs within the U.S. Department of Energy to research and develop deepwater drilling technologies and practices that mitigate risks. In particular, Section 999 of the Energy Policy Act of 2005 has not been funded since it was established, and Congress has funneled small sums towards these research programs. The Deepwater Horizon explosion makes clear that Congress and the Obama Administration have a responsibility to provide adequate Federal funding for research on how oil companies who engage in deepwater and ultra-deepwater drilling can prevent explosions and quickly respond when something does go wrong.

Second, it appears that the blowout preventer (BOP) on Deepwater Horizon is likely the source of the explosion, fire, and leak. This BOP passed through several international companies and was never tested at 5,000 feet before it was put in use in the Gulf Both British Petroleum and Transocean have no experience with a failure of these dimensions at this depth or to fix the leak. Even if more extensive testing were required, according to researchers, precisely replicating the conditions of a deepwater drilling site in a laboratory setting is nearly impossible. However, without appropriate testing, companies have no knowledge of the risks they may face at 10,000 feet below sea level or how best to respond when something does go wrong. I would like to hear from our witness what safety tests they complete before deploying new drilling technology in deepwater. Further, I am interested in how researchers account for differences between real-life and laboratory conditions and what role Congress can play in improving the current testing programs to better replicate the conditions in deepwater drilling sites.

I welcome our panel of witnesses and I look forward to their testimony.

And now, it is my pleasure to introduce our first panel of witnesses at this time. Mr. James Pappas is the Vice President of Technical Programs at the Research Partnership to Secure Energy for America. My staff here has given me the acronym we all know as RPSEA but unfortunately the way they have written it, it looks like R–I–P–S–E–A, which is rather unfortunate. Dr. Benton Baugh is the President of Radoil, Incorporated. Dr. Erik Milito is the Group Director of Upstream and Industry Operations at the American Petroleum Institute. Did I say that right?

Mr. MILITO. No, you just gave me a doctorate, and I appreciate that.

Chairman BAIRD. Well, I have got a doctorate. I am not sure that is a promotion, so you pick. I will call you whatever you want. When we say there is a doctor in the house, we won't look at you.

And Mr. Greg McCormack is the Director of the Petroleum Extension Service at the University of Texas in Austin, a very distinguished and capable group of witnesses. As we discussed before with the witnesses, you have five minutes for your spoken testimony. We will have lots more time after that in the Q&A with the panelists so you will have more time, and feel free at some point, you know, if we haven't asked a question that you think is important, feel free to, you know, speak out on that. We will try to lead things in a good direction here, but if there is something really critical, let us know. When you have completed your spoken testimony, we will begin with questions. Each Member of our panel will have five minutes to question the witness.

And with that, Mr. Pappas, please begin. Thank you all for being here.

STATEMENTS OF JAMES PAPPAS, VICE PRESIDENT, TECHNICAL PROGRAMS, RESEARCH PARTNERSHIP TO SECURE ENERGY FOR AMERICA

Mr. PAPPAS. Thank you, sir. Good morning, Chairman and Members of the Subcommittee. I represent RPSEA, and the Marine Technology Society also asked me to represent it today.

The Research Partnership to Secure Energy for America, RPSEA, is a 501(c)(3) nonprofit organization. Through the Energy Policy Act of 2005, section 999, RPSEA administers a public-private partnership that performs research and development for the ultra deepwater Gulf of Mexico on conventional onshore natural gas and other petroleum resources in the United States, namely small producing companies. RPSEA has over 170 member companies, including 26 research universities, companies and other organizations and it manages $37.5 million per year of U.S. government funds plus cost share from project groups. Government funds are generated from royalties and distributed to RPSEA through NETL on behalf of the U.S. Department of Energy.

RPSEA is unique in that we administer our program through a collaborative research environment that includes subject-matter expert volunteers from leading research universities, vendor companies and Federal organizations, small operators, individuals, private labs, government labs and offshore operators. Furthermore, RPSEA is proud and fortunate to have members from several prominent environmental and safety concerns within our ranks. The fully transparent process that we have has proved to result in high-quality technology and research development. We currently have 71 projects in progress or completed and an additional 28 projects are in contract negotiations.

I have been invited to discuss oil prevention and mitigation technologies in deepwater, as well as standards for deepwater gas and oil drilling. We pinpointed several areas of study, including technology enhancement to minimize incidents. This program will identify and develop technologies to prevent incidents from occurring in the first place. These technologies will improve safety, protect the environment, and ensure well bore integrity of offshore operations. The program should consist of an evaluation of existing safeguards and international offshore procedures, standards and practices. It should also identify promising technologies to address safety and environmental concerns associated with deepwater and harsh environments.

Identification, development, and improvement of proactive and reactive response procedures and processes will address the research required to minimize response time to an incident so that environmental impact is also minimized. The industry has various vessels and equipment on standby use to contain spills, to skim, or to deploy dispersants. A research program should be established to identify state-of-the-art technologies and methodologies and identify other necessities to enhance response to an emergency situation. This program can also include early warning sensors to identify potential hazards to the environment.

The second area of study is the development of an understanding of the value ecosystems services and location identification of high-value and seasonally dynamic ecosystems. The goal of this program would be to study deepwater coastal regions in the Gulf Coast wetlands in order to identify high-value areas and to place monitoring and early warning devices in there.

RPSEA has several research projects that relate to safety and environmental studies ongoing already. In addition, every project that RPSEA has in its program is required to employ a level of understanding of safety and environmental impact. Example projects are detailed in my written statement. They include the self-standing riser system that has recently been developed with an ongoing demonstration project for use in deepwater well interventions. This technology can enable operators to do various deepwater tasks more safely.

RPSEA, through its oversight by the Department of Energy, stands at the forefront of the development of systems to enable industry to improve energy security. The Research Partnership to Secure Energy for America uniquely provides the structure for researchers and other interested parties from a multitude of research universities, environmental organizations, safety concerns, companies, and others to exchange ideas, transfer technologies, and provide unbiased science to develop sound policies so that industry can operate in a safe manner. It is because of the role of the Federal Government through the EPAct section 999 program that RPSEA has been successful and that its members are willing and anxious to participate, to lead in these activities that are so important to our country. Funding currently is not sufficient to pay for all of the projects that have been recommended by our expert review panels.

Thanks for the invitation and the opportunity to discuss the ongoing research and needs related to deepwater spill prevention and mitigation.

[The prepared statement of Mr. Pappas follows:]

PREPARED STATEMENT OF JAMES PAPPAS

Good morning, Chairman and members of the Subcommittee. My name is James Pappas. I am employed by the Research Partnership to Secure Energy for America, RPSEA—a 501(c)3 non-profit organization (*www.rpsea.org*). Through the Energy Policy Act of 2005 Section 999, RPSEA administers a public-private partnership that performs research and development for the ultra-deepwater in the Gulf of Mexico, unconventional onshore natural gas, and other petroleum resources of the United States, namely for small producing companies. RPSEA has over 172 members, including 26 research universities, companies, and other organizations and manages the $37.5 million per year of U.S. Government funds, plus cost share funds from project groups. RPSEA is unique in that we also have an Environmental Advisory Group that enables prominent environmental organizations to assist us in managing our program. Government funds are generated from royalties and funneled to RPSEA through NETL, the National Energy Technology Lab, on behalf of the U.S. Department of Energy. Additionally, the National Energy Technology Laboratory at the Department of Energy (NETL) has a $12.5 million per year complementary program under the same Act. Our two groups work together to ensure that research is properly prioritized and funding is effectively utilized.

Deepwater offshore exploration and production is challenging in many respects. Each prospect is full of unknowns, and the industry must be prepared for the worst. Its toolkit is vast but it has not kept up with the challenges. A proactive approach that studies possible outcomes, plans and prepares people, contains the proper amount of safety features and methods to employ them, sets responsible oversight and regulations, and is available to all for use is paramount to the safe and environmentally responsible success of the judicious use of America's oil and gas resources.

RPSEA, through its oversight by the Department of Energy through NETL, stands at the forefront of the development of systems to enable the industry to improve energy security. The Research Partnership to Secure Energy for America uniquely provides the structure for researchers and other interested parties from a multitude of companies, research universities, environmental and safety organizations, and others to exchange ideas, transfer technologies, and provide unbiased science to develop sound policy. It is because of the role of our Federal Government through the EPAct Section 999 Program that RPSEA has been successful and that its members are willing and anxious to participate—to lead—in these activities that are so important to our country.

RPSEA is unique in that we administer our program through a collaborative research environment that includes subject matter expert volunteers throughout the oil and gas industry, outside of the industry, research universities, national labs, and other state and Federal organizations. Furthermore, RPSEA is proud and fortunate to have members from several prominent environmental and safety concerns within our ranks. The inclusion of so many experts from such a large base makes this program a success. All stakeholders are represented. Our fully transparent process has proved to result in high quality technology research and development that is advancing all sciences related to our function. Thus, this one-of-a-kind, all inclusive organization truly represents the public interest. We currently have 71 projects in progress or completed, and an additional 28 projects are in contract negotiations.

Through our experts, who cover all technical disciplines, we develop a five-year plan that we update annually. Specifically, the annual plan (*http://www.rpsea.org/annual-plans*) is submitted by RPSEA only after an exhaustive and comprehensive review of technology ideas generated by nine committees of subject matter experts. More than 700 individuals work to identify and develop these ideas and the subsequent plan. RPSEA takes its direction from the Secretary of Energy when he approves the annual plan after consultation with a Federal Advisory Panel. The needs are prioritized, we balance our near and long term goals, and then we publicly issue requests for proposals. Proposals are evaluated by independent experts and projects are selected that follow Federal Acquisition Regulations. Each project must not only meet the technical objectives, but it must also provide a plan that ensures that the technology will be safe and have no adverse environmental impact. In fact, some of the current projects specifically address improved safety and environmental performance. Although the projects are managed by RPSEA, they utilize industry advisory boards to assure that they meet their objectives. This process is meant to act as a check-and-balance, and it also assists in early development and commercialization of any related technologies. Our aggressive technology transfer efforts ensure the work being conducted is applied in a cost effective manner.

I have been invited to discuss oil spill prevention and mitigation technologies in deep water, as well as standards for deepwater gas and oil drilling. The recent incident involving the Deepwater Horizon is a tragedy that has resulted in the loss of 11 lives, an environmental nightmare, and hardship on countless Americans. Clearly, no one expected this incident to happen. The U.S. offshore drilling industry had an extraordinary safety record prior to its occurrence. Quite appropriately, the incident has resulted in everyone reflecting, refocusing, and rethinking the importance of offshore production, as well as the research required to ensure the safe and environmentally sound production of these precious resources. As efforts continue to rein in the blowout, to clean-up the environment, and to identify the root cause of the accident, the failure of the overall system and the resulting impacts have already identified specific areas requiring research.

Through RPSEA's Environmental Advisory Group, as well as its Drilling Advisory Group, we have pinpointed several areas of study:

- **Technology enhancement to minimize incidents**—This program will aim to prevent incidents from occurring in the first place. A review of the state-of-the art of technologies that may be used to improve safety, protect the environment, and ensure wellbore integrity of offshore operations will identify priorities, as well as technology gaps and further research needs. The review should consist of an evaluation of existing safeguards and international offshore procedures, standards, and practices. It should also identify promising technologies to address safety and environmental concerns associated with deepwater, harsh environments.

  One of RPSEA's projects, the **Environmentally Friendly Drilling Systems Program** (*www.efdsystems.org*), enlists the participation of several research universities, national laboratories, and industry contributors. Its advisory committee includes members from all stakeholder groups including environmental

organizations, academia, industry, and other concerned citizens. The project is focused on identifying and developing new technologies for environmentally sensitive development of unconventional onshore energy resources. Its objective is to identify, develop, and transfer critical, cost effective, new technologies to allow onshore reserves development in a safe and environmentally friendly manner. This project can serve as a model for a similar offshore program that will enable all stakeholders to identify needed research, to provide direction, and to follow progress. Furthermore, the new offshore program can be developed using the same organizational structure as the Environmentally Friendly Drilling Systems Program, and might also explore various approaches to regulate safe activity in the offshore sector, in addition to identifying and developing new technologies. For example, it might investigate the feasibility of a performance-based systems approach to enhance or complement the current prescriptive-based method of laws and regulations. It might also address recommendations contained in the Secretary of Interior's May 27, 2010 report: "Increased Safety Measures for Energy Development on the Outer Continental Shelf," particularly recommendations concerning well control systems and safety equipment. Other research needs related to wellbore integrity include cement evaluation technologies, methods to maintain communication and power between the surface and subsea safety systems, and increasing the intervention capability of remotely operated vehicles.

- **Identification, development, and improvement of proactive and reactive response procedures and processes** will address the research required to minimize response time to an incident, so that environmental impact is minimized. The primary response objectives in any open-water marine spill are:
  - Prevent the spill from moving onshore
  - Reduce the environmental impact
  - Speed the degradation of any unrecovered oil while minimizing the harm on the ecosystems
  - Mobilize rapid well intervention/containment standby equipment

  The industry has various vessels and equipment on standby used to contain spills, to skim, and to deploy dispersants. But quite frankly, the research in this area has been lagging and as evident was not prepared for this past incident. RPSEA is in a position to immediately conduct a research program to identify the state-of-the-art technologies and methodologies to enhance a response to an emergency situation. The Secretary of Interior's report, previously mentioned, also recommends a comprehensive study of methods for more rapid and effective response to deepwater blowouts. This program can also include early warning sensors to identify potential hazards to the environment. And it should also include studies to understand the effect on marine life and other wildlife movements resulting from an incident. Other evaluations might include the effects of using different dispersants on the ocean and marine life, advancing skimming technologies and separation/water handling technologies, prescribed burns impacts, and general emergency preparedness logistics improvements.
- **Development of an understanding of the value of ecosystem services and location identification of high value in a seasonally dynamic ecosystem**—This program will aim to determine the value of ecosystems. The goal is to study deepwater, coastal regions and Gulf Coast wetlands, in order to identify high value areas to place monitoring and early warning devices. Valuation of ecosystem services can furthermore be used to prioritize spending on ecosystem protection.

RPSEA has several research projects related to safety and environmental studies. In addition, every project in the RPSEA program is required to employ a level of understanding of safety and environmental impact. Example projects include:

- Our **composite riser for ultra-deepwater high pressure wells** project is aimed to decrease weight requirements, thus easing the task of riser installation and reducing the potential for human injury.
- The **fatigue performance analysis of high strength risers in sour environments** project is aimed to improve our understanding of long term riser fatigue physical changes under various dynamic conditions, for various fluid types.

- The **effects of climate change on hurricane activity** project is a study to better forecast storms in the Gulf of Mexico that can inevitably allow companies to safely and effectively shut down operations and may have an additional benefit of improving hurricane early warning for all Gulf Coast Americans.
- Included in another project is a **Self Standing Riser System** (SSR) that has recently been developed, with a demonstration project for use in deep water well intervention ongoing. This technology includes a riser and an adjustable air can that may enable operators to do various deep water tasks in an easier, timelier, and safer manner. The system may include blowout preventers at both the mudline (seafloor) and at the water's surface, adding redundancy to current systems.
- Both the **hybrid power systems study** and the **ultra-deepwater electrical power distribution systems** projects aim to place power where it is needed—near the wellhead. Doing so can increase monitoring and control capabilities, add levels of redundancy to current systems, and reduce response times.
- Similarly, **wireless subsea communications** can be a game changer when it comes to monitoring and control.
- The **new technologies to monitor and inspect pipelines** project has the potential to revolutionize early warning methods in that arena.
- The **3–D, high resolution, laser imaging** project similarly has the potential to greatly improve offshore equipment inspection, maintenance, and repair.

Abstracts describing each of these projects and others can be found online under the RPSEA public access section at *http://www.rpsea.org/en/cms/?1475*

When the thorough investigation of the Deepwater Horizon incident is completed, there will be identified needed changes in deepwater drilling standards. Areas that might, require additional standards or recommended practice development include:

- Blowout preventer inspection and enforcement procedures, including backup equipment, and reporting requirements
- Well control procedures, training programs, and/or response mechanisms for deepwater wells
- Improved comprehensive safety management programs
- Emergency equipment certification and testing improvements
- Streamlined reporting systems to Governmental agencies
- Additional safety barriers during critical well construction stages
- Well construction certification procedures for cement and tubular equipment
- Standardized well construction procedures from wellhead to the reservoir
- Increased enforcement by Government agencies, including training and development of additional personnel

RPSEA is currently in the process of developing our **2011 Annual Plan** for research. The Deepwater Horizon incident has greatly influenced us, and thus we will place even more emphasis on safety and environmental research. The Deepwater Horizon incident has greatly influenced us, and thus we will place even more emphasis on safety and environmental research. We must do all we can to make certain that an incident like that involving the Deepwater Horizon never happens again.

The value of collaborative research is important. It is precisely because of government funding that a combined group from academia, research organizations, and industry can perform this type of research, which otherwise would not be cost effective. Thanks to government funding through the Energy Policy Act, coupled with significant industry cost share, the higher risk technology challenges are being addressed, The Section 999 funding of $50 million per year ($37.5 million to RPSEA and $12.5 million to NETL for complementary research), has been far from sufficient to address all the concerns. I hope you will agree with the over 170 member companies of RPSEA that this program is a great value to our country. We could be far more effective if additional funds that have been authorized were appropriated.

The universities, the subject matter experts, the vendor community, the small producers, and the major integrated operators, in cooperation with NETL and the DOE, have the network in place to immediately begin to develop the technologies needed to add increased safety and environmental protection to our drilling efforts. I urge you to see RPSEA as a part of the solution to balancing our nation's energy

imperatives and environmental requirements. We are ready now. We have the network now. We are up and running and there will be no delay because our relationship with the government and other stakeholders is already in place. We can begin developing solutions now.

Thank you for this opportunity to discuss the ongoing research and needs related to deepwater spill prevention and mitigation.

BIOGRAPHY FOR JAMES PAPPAS

James Pappas is Vice President of Technical Programs for RPSEA, the Research Partnership to Secure Energy for America, in Sugar Land, TX. He has held the positions of Global Technology Coordinator, Facilities Engineer in the Deepwater & International Well Engineering & Facilities Division, Deepwater Project Coordinator for Devon Energy in the past, as well as Production Engineer in the Gulf of Mexico Division for Devon, and Santa Fe Snyder prior to their merger. He has also held drilling, completions, production, operations superintendent, reservoir, and acquisitions and divestitures (A&D) positions with Fina Oil and Chemical Company, UPRC, and Amoco Production Company.

He has been involved with the Society of Petroleum Engineers for 30 years. He is both the immediate past SPE International Production and Operations Technical Director and SPE Technical Programs and Meetings Committee Chair, and is a former chair of the 13,000-member SPE–Gulf Coast Section. He serves on several technical program committees for meetings including: the Offshore Technology Conference (OTC), SPE Annual Technical Conference and Exhibition (ATCE), the Latin American Continental Petroleum Exhibition and Conference (LACPEC), the SPE R&D Conference, and the SPE Production & Operations (P&O) Conference. He is also the immediate past Private Industry Practice Chair and Executive Committee member of the Texas Society of Professional Engineers and serves on that body's Legislative and Governmental Affairs Committee. He is also active in the American Petroleum Institute (API), National Society of Professional Engineers (NSPE), the American Association of Drilling Engineers (AADE), and Marine Technical Society (MTS), and he chairs the University of Texas Petroleum Engineering Advisory Council.

James has authored over 40 papers or spoken at various conferences and interviews on various technical and professional topics including: Monte Carlo reservoir simulation, hydraulic fracture analysis, well conformance remediation, subsea tiebacks, flow assurance issues, floating platform concepts, project management, drilling, government and the oil and gas industry, engineering, professionalism, recruiting, training and development, retention, volunteerism, and ethics.

James earned a Bachelor of Science degree in Chemical Engineering, as well as a Bachelor of Arts in Chemistry with Math and Spanish minors, from the University of Texas at Austin in 1979. He graduated with a Master of Business Administration with highest honors from the University of Texas at Tyler in 1993. He has earned numerous accolades including the SPE Gulf Coast Section and Gulf Coast Region Service Awards, Houston Area Engineer of the Year in 2007, Texas Engineer of the Year by the Texas Society of Professional Engineers in 2008, and was selected Distinguished Engineer in Texas by the Texas Engineering Foundation in 2008. He has been a Registered Professional Engineer in Texas since 1985.

Chairman BAIRD. Thank you, Mr. Pappas.

Dr. Baugh.

STATEMENTS OF BENTON BAUGH, PRESIDENT, RADOIL, INC.

Dr. BAUGH. My name is Benton Baugh and I have been asked to give testimony on the current state of the drilling equipment and whether or not it provides an adequate level of safety for doing deepwater drilling. It is my opinion that the systems are currently developed to a state that they are completely adequate to provide protection to the environment and safety of the personnel. My opinion is based upon working in this industry for more than 50 years, having received more than 100 U.S. patents primarily in this area, and specifically having received a patent on almost every subassembly of a deepwater drilling system.

Subsea drilling has existed for about 50 years—from the early 1960s when it was considered to be ultra-deep drilling to drill in 250 feet of water, to now where we are commonly making equipment for 10,000, 12,000 feet of water. Overall, there is an impressive safety record for having drilled in this time.

The subsea business that we are talking about—and I will be talking primarily from the point of view of a manufacturer—the subsea business system is dominated by three major manufacturers. Each of these has highly specialized safety systems, highly developed manufacturing systems, and each of them has ISO-quality certification and follows conventional practices of design, testing, and verification of their equipment. You can fully expect that any equipment in the field has been pressure-tested to 50 percent higher than the pressure it will ever see in the field. It has been loaded to loads 50 percent higher than any load that it is ever expected to see in the field. You can also expect that this equipment is regularly tested in the field, and is certified on an ongoing basis to maintain the quality of equipment.

The company I work for is a second-level company, and that means that, basically, we sell equipment to a first-level company who provides it directly to the operators. On the first slide you see here is a set of reels which we would provide to a company like one of the major first-level companies. The yellow and blue reel there handles electrical umbilicals that go down and control the control pods on the sea floor. The white one will be a hydraulic hose that takes hydraulic power down and provides power for the systems on the sea floor.

What you see on the left of this slide is an ISO 9001 certification which our company has received. It is a certification that we have systems in place to maintain quality and traceability of all equipment that we do. It is a very difficult certificate to get for a manufacturer. On the right side is a type of approval certificate which is for a piece of equipment. It says that not only a third party, in this case, Det Norske Veritas, has certified that we have good equipment. They have it certified as a standard type of equipment, so in the future anything similar to that is automatically approved, because they have done a complete analysis on it.

On this slide, what you will see is what we call a FAT test. We do this on every piece of equipment that leaves our company. On the left side is simply the cover sheet of it. On the right side, what you see is page ten of 15 of the FAT test, and what you will notice coming down is, on the left column, there will be a signature by the Radoil employee that confirmed that this step was successfully accomplished during this FAT test. Toward the center of the page you will see little round circles. That means that the customer's inspector has come and has certified that this has successfully passed the test as specified. On the right there is an oval stamp. That is the American Bureau of Shipping. That says a third party has come in and has certified that it has passed these steps in the test. This happens over 15 pages on these reels and this is characteristic of what you would expect in the offshore industry. All of our products don't require this level of quality, but this is characteristic of what you would expect to see if something goes offshore.

Again, these are practices you would expect of all the first-level manufacturers. There is an obligation, basically, that if a manufacturer buys something from an ISO-certified supplier, you automatically get accepted as a supplier. For instance, if we choose to accept some equipment from someone that is not ISO certified, it becomes our requirement to do the ISO certification for it. We must do the inspection, we must do all things to make it good. Again, this is what you expect from these first-tier providers. They provide good equipment. It is very well certified.

The well that we are talking about here is not something where they were doing experimental things, pushing the envelope. It was drilled in about 5,000 feet of water. It is very likely that this very same rig had drilled in at least 10,000 feet of water, and, I can assure you, if it hadn't drilled in 10,000 feet of water, it was most likely certified to be able to drill in 10,000 feet of water. There is very little difference when you go offshore between drilling in 1,000 feet of water and 10,000 feet of water. It is just wet. The biggest change you see is what happens on the nitrogen accumulator banks, and that is a well-studied subject, but, basically, there is very little difference in 1,000, 5,000 or 10,000 feet of water. This is highly capable equipment.

Again, the actual cause of what we are talking about here may never be known. Depending on how we get closure on this particular well, it could be submitted up right to the top and never touch it and not ever take a chance on the thing, but it appears reasonable that there is a good chance it had nothing to do with equipment, that it had to do with the ways some operations were done. It is potentially not an equipment problem at all.

Chairman BAIRD. Dr. Baugh, I am going to ask you to conclude at this point. We have got five minutes per witness, and——

Dr. BAUGH. Oh, I am sorry.

[The prepared statement of Dr. Baugh follows:]

PREPARED STATEMENT OF BENTON BAUGH

I have been asked to give testimony as to whether current subsea drilling equipment is sufficiently developed to provide an adequate level of safety for deepwater drilling operations.

It is my opinion that the current state of technology of subsea drilling system is completely adequate to provide an appropriate level of safety to control wells being drilled, protect the environment, and provide safety for personnel. The basis of my opinion is more than 50 years of working in oilfield equipment design and manufacturing, receiving more than 100 U.S. patents, and having personally received a patent on almost every subassembly of a subsea drilling system.

Subsea drilling systems have existed for approximately the same period of time, from the early 60s when 250′ of seawater was considered ultra-deep, until now when we are drilling in 12,000′ of seawater. Overall they have an impressive safety record. The BOP or blowout preventer stack is a piece of seafloor equipment approximately 12 foot square by 80 feet tall which typically weigh 600,000 to 800,000 lbs. They are connected to a surface vessel by a 21″ outside diameter steel riser pipe with flotation added to give it approximately a four foot diameter.

This subsea equipment business we are discussing is dominated by 3 major first level manufacturers. Each of these suppliers have highly developed and refined systems. Each of these suppliers is ISO quality certified and follows conventional procedures of design, development, testing, and independent verification. You can fully expect that any system in the field has been tested to loads and pressures 50% higher than the loads and pressures ever anticipated to be seen in operations, and that the testing has been verified by independent third parties. You can equally well expect that the equipment is regularly tested to the maximum working pressures to confirm ongoing workability.

The company I work with is a second level company which sells large reels to each of these first level suppliers. On the first slide presented you can see a set of these reels of the type which will hold 10–12,000′ of umbilical or hose to send signals and power to the subsea BOP control pods. The second slide on the left hand side shows a copy of the ISO 9001:2008 certification which we have received to certify that we have systems in place to promote the delivery of quality products. The right side of the same slide shows a "Type Approval" which we have received for a design, implying that not only has a 3rd party certifier checked the design, but has approved it as a type of design.

The third slide shows a factory acceptance test or FAT test for a product, in this case a reel. On the left side is the first page of the FAT and on the right side is page number 10 of 15 pages of this FAT test. On the right side you will notice that our personnel have signed that each step has been successfully accomplished. Each of the small round stamps indicate that our customer's quality control personnel have witnessed and confirmed each requirement. Each of the oval stamps indicates that an independent third party, in this case the American Bureau of Shipping, has witnessed and confirmed each step. This occurs on every performance step, every pressure step, and every load step. All of our products do not require this level of quality and verification, but this is characteristic of what goes offshore.

These are the practices you would expect of the current first level suppliers. Clearly the systems for appropriate design, testing, and verification are in place today.

The well in question does not represent a "pushing of the envelope" in terms of what has been done. It is in 5000′ of water and likely the exact rig had drilled other wells in depths greater than 10,000′. There is very little difference in drilling in 1000′ of seawater and 10,000′ of seawater. Probably the biggest difference is in what happens to the nitrogen charge in the accumulators which is well studied. The actual cause of the current problems is not known, and may well never be known depending on how ultimate closure happens to this well. Clearly it is the confluence of a number of events, none of which may have been the fault of the drilling system.

In spite of the current difficulties with the Maconda well blowout, there have been approximately 4000 offshore wells drilled and the last significant spill from a U.S. offshore well was in the Santa Barbara Channel, about 30 years ago. This is an impressive record of complex systems handling the critical sources of energy upon which our civilization is based.

The present question is whether a work stoppage will improve or reduce safety and technology. There is not a question whether we need fossil fuels in our lifetime. In spite of substantial investments to do so, it is clear that there will be no substitute for fossil fuels in our lifetime. A substantial work stoppage or moratorium will mean:

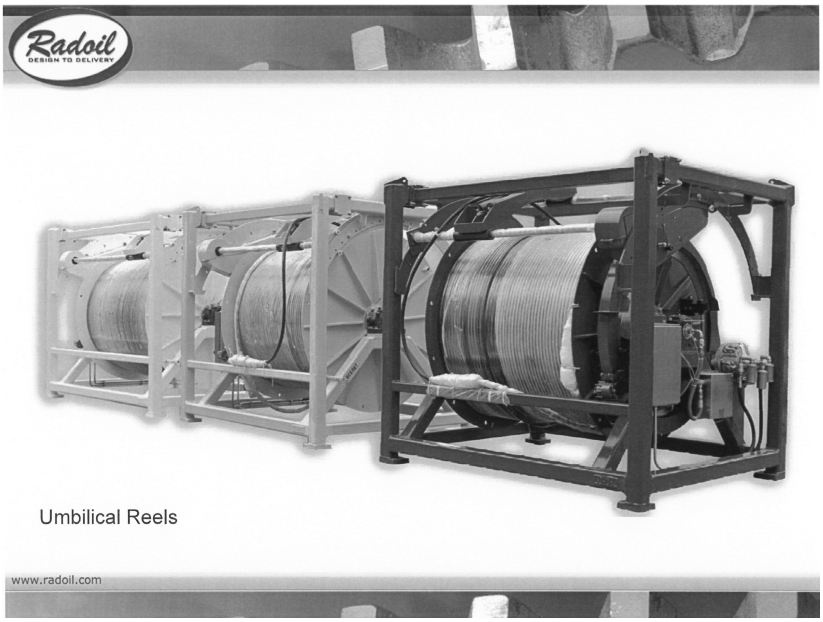
1. A reduction in safety because when the work restarts it will restart with a high percentage of less skilled workers. The most dangerous time for operations is when new workers start up a new task, and that is exactly what this will cause.
2. A reduction in safety because stopping drilling will cause more oil to come from foreign sources by tanker. It is far less safe for oil to be brought to the U.S. by tanker than it is to flow in a passive subsea pipeline to the shore. In fact, the last significant spill oil spill in the U.S. was that of a tanker—the Exxon Valdez.
3. Financial damage to the work force and U.S. companies will likely be more extensive than the oil spill itself, with no one to pay for it.

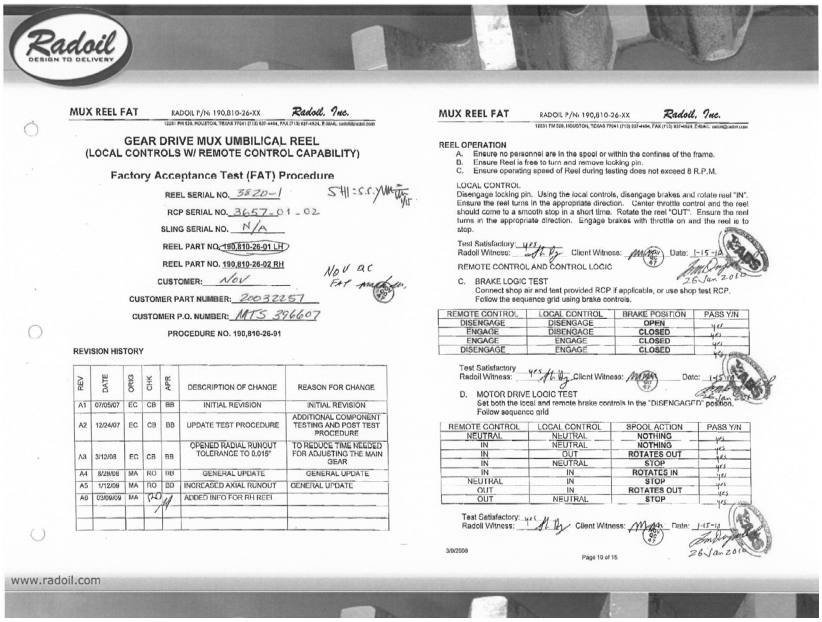
I assure you that the technology is in place and the systems are in place to do safe deepwater drilling. For these reasons I recommend:

1. The moratorium be lifted as soon as practical.
2. As equipment comes back to the surface, it be retested to confirm compliance with original factory acceptance testing and systems integration testing and have full independent 3rd party verification. If it is, the rig needs to go right back to work and continuity of the work force needs to continue.
3. All equipment and systems fabricated for collecting the present spill be captured and further developed in case another spill happens in the future.
4. Shear rams and shear ram actuators need continuing development as the wall thickness and material strength of the drill pipe is increased.
5. Tertiary back-up systems be commonly defined and implemented.
6. ROV interface systems be further developed for a fourth level of back-up control.

7. To a large extent, if existing rules, regulations and practices are enforced the overall quality and safety of the industry will be approved.

I encourage and promote ongoing and aggressive new product development and systems upgrade, not for 6 months but forever. At this time, in the past, and in the future it has been or will be appropriate to pursue upgrades in safety and technology. We will never reach perfection except in the smallest areas. We need to put our people and the country back in business now, not after some future arbitrary date.





BIOGRAPHY FOR BENTON BAUGH

Benton F. Baugh, Ph.D., P.E. is President of Radoil, Inc. which does oilfield engineering and manufacturing and Baugh Consulting Engineers, Inc. which does oilfield related consulting and expert witness work. Significant product areas are Reels

for Deepwater Control Systems, Deepwater Drilling Riser Centralizers, J–Lay Pipeline Towers, Arctic Platforms, and pipeline blockage remediation activities.

He is a registered professional engineer having earned a BSME degree from the University of Houston and earned MS and Ph.D. degrees from Kennedy Western University. Prior to starting his own businesses, he worked with Beta Division of Brown Oil Tools, Vetco Valve Company, Vetco Offshore, Cameron Iron Works, Camco, and Bowen Tool Company

He is a member of the National Academy of Engineering, an Adjunct Professor at the University of Houston, a Fellow in the American Society of Mechanical Engineers; and a member of the Marine Technology Society. He has written numerous technical papers, holds more than 100 patents, has been Chairman of the ASME Petroleum Division, President of the University of Houston Engineering Alumni Association, Chairman of the ASME/UH OTC Cajun Crawfish Boil, on the Board of Directors of the Offshore Technology Conference and on the Board of the Offshore Energy Center.

Chairman BAIRD. That is all right. If there will be other points you want to make, I am sure we will have a chance to do those in questioning.

Mr. Milito.

STATEMENTS OF ERIK MILITO, GROUP DIRECTOR, UPSTREAM AND INDUSTRY OPERATIONS, AMERICAN PETROLEUM INSTITUTE

Mr. MILITO. Good morning, Chairman Baird, Members of the Subcommittee. Thank you for the opportunity to address deepwater technology, research and development. My name is Erik Milito and I am the Upstream Director for the American Petroleum Institute. API has more than 400 member companies which represent all sectors of America's oil and natural gas industry. Our industry supports 9.2 million American jobs, including over 170,000 in the Gulf of Mexico related to the offshore development business, and this industry provides most of the energy that America needs.

First, our thoughts and prayers go out to families who have loved ones, to the workers who were injured, and to our neighbors in the Gulf who are affected by this tragic accident.

In testimony just last month, Secretary Salazar said the offshore oil and natural gas industry is a very highly regulated industry. Indeed, offshore operators are subject to 27 statutory authorities, 88 CFR parts in terms of the Federal regulations, and 27 permits and approvals. All these apply to offshore operations. However, our industry's top priority is to provide energy in a safe, technologically sound and environmentally responsible manner. We thus take seriously our responsibility to work in cooperation with the government to develop practices and equipment that improve the operational and regulatory processes across the board. We support the government's ongoing review of the incident and the existing systems in place. The industry will take the necessary steps to prevent accidents like this from occurring again.

As further proof of our commitment, API has been the leader for nearly nine decades in developing voluntary industry standards that promote reliability and safety through proven engineering practices. API's standards program is accredited by the American National Standards Institute, the authority on U.S. standards, and undergoes regular program audits to ensure it meets ANSI's essential requirements. API standards are developed through a collaborative effort with industry experts, as well as the best and bright-

est technical experts from government, academia, and other stakeholders.

API maintains more than 500 standards which include recommended practices, specifications for equipment, codes, technical publications, reports, and studies that cover all aspects of the industry, including 240 focused on exploration and production activities related to offshore development. The standards are normally reviewed every five years to ensure they remain current, but some are reviewed more frequently based on need. In the case of the Deepwater Horizon incident, we are already going to work and we have activity in place to review standards and to develop new standards already. API standards are frequently referenced in Federal regulations because they are recognized to be industry best practices. The Minerals Management Service references 78 API standards in its offshore regulations. Overall, nearly 100 API standards are referenced in more than 270 citations by government agencies, including the Environmental Protection Agency, the U.S. Department of Transportation, and the Occupational Safety and Health Administration, in addition to the MMS.

Complementing our standards program, API has a separate industry quality program. First established in 1924, the API Monogram provides for the consistent and reliable manufacture of equipment and materials in accordance with our standards and recommended practices. The program grants manufacturing licenses for more than 70 API equipment specifications. The Monogram program is governed by consensus committees consisting of technical experts from the industry, government, academia, and other stakeholders. More than 5,000 licenses have been issued to some 3,000 facilities in 70 countries to companies ranging from small firms to multinational corporations making a wide range of equipment.

The industry is committed to a goal of zero fatalities, zero injuries, and zero incidents. I appreciate the Chairman's comments at the outset which recognize the efforts in the Gulf region, and the industry is committed to helping out in those efforts and has already taken steps to look across at what the industry is doing throughout offshore operations to elevate industry standards to make sure that we have the best systems in place. Immediately following the incident, the API and the industry as a whole assembled the world's leading experts to conduct a top-to-bottom review of offshore drilling procedures from operations to emergency response. Two industry task forces that are addressing issues related to offshore equipment and offshore operating practices delivered recommendations to the Interior Department last month. In fact, the Interior Department report of May 27th actually includes a lot of the recommendations made by industry with regard to equipment and procedures. Two other task forces to address subsea well control and oil spill response have also begun their work.

We intend to use any findings from the incident investigation to continue to improve the technologies and practices to achieve safe and environmentally sound operations. As part of this process, we will work to develop new API standards, and will revise and adapt existing standards to raise the bar of performance. We look forward to providing constructive input as this Committee, the Congress, and the Administration consider changes to existing policy.

This concludes my statement, Mr. Chairman, and I welcome questions from you and your colleagues. Thank you.

[The prepared statement of Mr. Milito follows:]

PREPARED STATEMENT OF ERIK MILITO

Good morning Chairman Baird, Ranking Member Inglis, and members of the subcommittee. Thank you for the opportunity to address deepwater technology research and development.

My name is Erik Milito. I am the upstream director for the American Petroleum Institute. API has more than 400 member companies, which represent all sectors of America's oil and natural gas industry. Our industry supports 9.2 million American jobs—including 170,000 in the Gulf of Mexico related to the offshore development business—and provides most of the energy America needs.

First, our prayers go out to the families who lost loved ones, to the workers who were injured, and to all of our neighbors in the Gulf affected by this tragic accident.

In testimony last month, Secretary Salazar said the offshore oil and natural gas industry "is a very highly regulated industry." Indeed, offshore operators are subject to significant Federal regulatory requirements, including 27 statutory authorities, 88 Code of Federal Regulations parts, and 24 significant approvals and permits.

However, our industry's top priority is to provide energy in a safe, technologically sound and environmentally responsible manner, and we therefore take seriously our responsibility to work in cooperation with government to develop practices and equipment that improve the operational and regulatory process across the board. We, therefore, support the government's ongoing review of the incident and the existing systems in place and industry will take the necessary steps to prevent accidents like this from occurring again.

As further proof of our commitment, API has been the leader for nearly nine decades in developing voluntary industry standards that promote reliability and safety through proven engineering practices. API's Standards Program is accredited by the American National Standards Institute (ANSI), the authority on U.S. standards, and undergoes regular program audits to ensure it meets ANSI's *Essential Requirements*. API's standards are developed through a collaborative effort with industry experts, as well as the best and brightest technical experts from government, academia and other stakeholders.

API maintains more than 500 standards—recommended practices, specifications, codes, technical publications, reports and studies—that cover all aspects of the industry, including 240 focused on exploration and production activities. The standards are normally reviewed every five years to ensure they remain current, but some are reviewed more frequently based on need.

API's standards are frequently referenced in Federal regulations because they are recognized to be industry best practices. MMS, for example, references 78 API standards in its offshore regulations. Overall, nearly 100 API standards are referenced in more than 270 citations by government agencies, including USEPA, the Department of Transportation and OSHA, in addition to MMS.

Complementing our standards program, API has a separate industry quality program. First established in 1924, the API Monogram Program provides for the consistent and reliable manufacture of equipment and materials in accordance with our standards and recommended practices. The program grants manufacturing licenses for more than 70 API equipment specifications.

The Monogram Program is governed by consensus committees consisting of technical experts from industry, government, academia and other stakeholders. More than 5,000 licenses have been issued to some 3,000 facilities in 70 countries to companies ranging from small firms to multinational corporations making a wide range of equipment.

The industry is committed to a goal of zero fatalities, zero injuries and zero incidents. It has already taken steps to improve safety and environmental performance in the aftermath of the Gulf incident. Immediately following the incident, we assembled the world's leading experts to conduct a top-to-bottom review of offshore drilling procedures, from operations to emergency response. Two industry task forces that are addressing issues related to offshore equipment and offshore operating practices delivered recommendations to the Interior Department last month. Two other task forces, to address subsea well control and oil spill response, have also begun their work.

We intend to use any findings from the incident investigations to continue to improve the technologies and practices to achieve safe and environmentally sound operations. As part of this process, we will work to develop new API standards and

revise and adapt existing API standards to raise the bar of performance to a higher level.

We look forward to providing constructive input as this committee, the Congress and the Administration consider changes to existing policy.

This concludes my statement, Mr. Chairman. I welcome questions from you and your colleagues. Thank you.

BIOGRAPHY FOR ERIK MILITO

Erik Milito is the Director of Upstream and Industry Operations for the American Petroleum Institute (API), which is the national trade association representing more than 400 companies involved in all aspects of the oil and gas industry, including exploration production, refining and transportation. Mr. Milito's work covers regulatory and legislative matters related to domestic exploration and production, including access to domestic oil and natural gas resources both onshore and offshore. Prior to his current position, Mr. Milito served as managing counsel covering a host of issues, including oil and gas leasing, royalty, environmental, fuels, transportation, safety, and civil justice reform. Prior to joining API, Mr. Milito served for over four years on active duty in the U.S. Army as a judge advocate, and additional four years in the U.S. Army Reserve, resigning at the rank of Major. Mr. Milito was assigned to active duty tours in Hawaii, Korea and Aberdeen Proving Ground, Maryland, and he served as a prosecutor, defense attorney and command advisor. Mr. Milito was awarded the Meritorious Service Medal and Army Commendation Medals during his military tenure. After leaving the Army, Mr. Milito worked as a career attorney with the Solicitor's Office of the U.S. Department of the Interior. While at Interior, Mr. Milito worked on royalty, employment law, and disability access issues. Mr. Milito attended the University of Notre Dame on an R.O.T.C. scholarship, and received a bachelor's degree in business administration. Mr. Milito then received his juris doctor from Marquette University Law School, where he was a member of the law review. Mr. Milito has authored and co-authored several papers related to natural resources issues and has served as a guest speaker on multiple occasions. Until recently, Mr. Milito served on the Board of Trustees of the Rocky Mountain Mineral Law Foundation. Mr. Milito and his wife Elizabeth have two children, William and Helen, and live in Alexandria, Virginia.

Chairman BAIRD. Thank you, Mr. Milito.

Mr. McCormack.

STATEMENTS OF GREG MCCORMACK, DIRECTOR, PETROLEUM EXTENSION SERVICE, UNIVERSITY OF TEXAS–AUSTIN

Mr. MCCORMACK. Mr. Chairman, Members of the Committee, and staff, thank you for inviting me to present and talk about training. Training is the key to safe application of industry technologies.

You may wonder why the University of Texas is here to talk about training. The University of Texas is a land-grant institution, which means when it was first established over 100 years ago, it was given three million acres out in west Texas. The three million acres then were worth nothing, but guess what? We found oil and natural gas on those three million acres, and so it became quite important to the University system. Back in 1944, the industry found itself with a skill gap shortage. The legislature of the State of Texas mandated that the University would provide training to the oil and gas industry, and we have been doing that ever since. We provide not only training, but we also provide training material and audiovisuals to the industry. We have trained Minerals Management Service, Bureau of Land Management, Homeland Security, JWAC, and most of the companies that are involved in the petroleum industry.

I personally have worked in the industry for 40 years and have seen many changes, and what hasn't changed is the impact of tech-

nology on this industry. It has been a technology-driven industry almost right from the inception. Training is a critical component of this industry, but it has not improved at the same speed as the technology. As a trend, I have observed over 40 years a shift from an investment-based industry to a more cost-focused business. Technology drives down cost. Unfortunately, training is looked at as cost and not an investment. Without appropriate training, technology comes with risk.

Today, training is down 25 percent over the training that was done in 2008. I would challenge the industry through its associations to have its members step up and increase their funding for training. The American Petroleum Institute, respected worldwide, a leader in setting standards in many places for the industry, should also be a leader in training standards. I notice a very direct correlation to profitability of the industry and the amount of investment and training. With fluctuating profitability, there is a fluctuation in training, and it should not be surprising that the results and effectiveness of training fluctuate, as well.

For the most part, the industry has created relevant content that should allow anyone who is trained in this content and passes appropriate testing to become knowledgeable about drilling rig safety and drilling rig operations. But training is not experience. This industry currently is losing experience at a faster rate than it is gaining it. So we have a problem in experience attrition.

One of the other real issues at hand is the growing multigenerational aspects of the workforce, with its mix of four distinct generations with disparate life experiences, varying ways of communicating, and distinctly different goals for professional careers. We have not learned how to train this multigenerational workforce.

The days of cheap oil are over. The great technological challenges in locating, drilling for, and producing hydrocarbons have taken a quantum leap forward in complexity. Unfortunately, training has not kept up with that complexity.

New technologies and training are invaluable. Ironically, it is the new generation that invented many of the new multimedia technologies. Fortunately, they are also very comfortable using those technologies. Though online training has existed for some time, in most cases, it has not been very interactive or intuitive. It is therefore necessary to rethink and reposition online training in formats that are familiar to newer generations of professionals.

What can the government do? I think the government can step in and look at the best practices of training that are underway today and pull those together and communicate them to all parties. It could include a training reporting system similar to the financial reporting system. They could audit the effectiveness of training providers. There is a great spectrum of training providers with great capabilities, and some with not so great capabilities.

The third area is to encourage the industry to fund fundamental research in how to train and retain the multigenerational workforce. Billions are spent on research; half a billion cumulatively spent on alternative fuels. I know of no funds that are being expended on research on training methodologies.

[The prepared statement of Mr. McCormack follows:]

PREPARED STATEMENT OF GREG MCCORMACK

Training is Key to Safe Application of Industry Technologies

Thank you for the invitation to present our views on Science and Technology as it pertains to training in the oil and gas industry. The University of Texas through PETEX (Petroleum Extension Service) has been providing training and training materials to the oil and gas industry since 1944. We work with the industry through its many organizations and associations to define its needs and produce quality training, publications and audiovisual products. I have personally worked in the industry for 40 years and have seen many changes, and what hasn't changed is the impact of technology on the industry. It has been a technology-driven industry almost from its inception. From locating oil from natural seeps to having the ability to drill in 12,000 feet of water to a total vertical depth of 30,000 feet, technology has enabled the industry to succeed. Without relatively inexpensive oil and gas, growth in world economies would have slowed.

Training is a critical component of this industry. As we drill deeper in more remote locations, the need for technology has become greater along with the need for training to apply technology safely and effectively. A trend that I have observed over my 40 years of experience is a shift from an investment-based industry to a

more cost-focused business. Technology drives cost down. Unfortunately, training is looked at as a cost and not an investment. Without appropriate training, technology comes with risk. Today, training is down by over 25% from levels experienced in 2008. I would challenge the industry through their associations to have their members step up and increase their funding for training. The American Petroleum Institute, the leader in setting standards in many places for the industry, should also be the leader in training standards. My perception is that there has been a reluctance to put capital into training because it is difficult to measure the return you get from that investment. On the other hand, everyone in a leadership role in the oil and gas industry has been educated and trained both as an undergraduate and in further development during in their career. I believe that they feel it was a wise investment. I am not sure that they feel that a similar investment in training for entry-level personnel is as valuable. I notice a very direct correlation to profitability of the industry and the amount of investment in training. With fluctuating investment in training, it should not be surprising that the results and effectiveness of the training fluctuates.

There are two different kinds of training required to safely and successfully operate a drilling rig, whether on land or over water. The first type of training relates to the operation and maintenance of the drilling rig itself. The second type of training is very specific to the oilfield services provided to support the drilling activities. These include, cementing, casing, drilling fluids, logging while drilling (LWD), measurement while drilling (MWD), running wireline, perforating, etc. The first type of training is usually provided by third-party training providers or carried out in-house. The second type is usually provided by the companies that are providing the oilfield services, because it is very specific to each individual company's equipment and products. I am going to address the first type of training.

The oil and gas industry faces many challenging issues in training, now and in the future. For the most part, the industry has created relevant content that should allow anyone who is trained in this content and passes appropriate testing to become knowledgeable about drilling rig safety and drilling rig operations. The knowledge gap created by "The Great Crew Change" that exists in most companies has been well documented and discussed. This knowledge gap was caused by inconsistent hiring during periods of low oil and gas prices. The problem is not one of filling the gaps. There are sufficient numbers of people entering the workforce to do that. The problem is one of "experience attrition," and it is a challenge that must be addressed. We should not expect that in replacing a retiring person with over 30 years of experience with an entry-level person that performance would not decline without extra efforts to replace years of experience with a significant increase in training. I don't see this situation being addressed. With large gaps in experience, personnel are promoted from one position to the next at a faster rate than in the past.

The characteristics and expectations of 'Generation Y' or the 'New Millennials' have been examined and debated. They learn differently and in much shorter spans of time. The real issues at hand are the growing multigenerational aspects of the workforce with its mix of four distinct generations with disparate life experiences, varying ways of communicating, and distinctly different goals for their professional careers. The first of the baby boomers reached age 60 in 2008. In perspective, the average age for retirement in the oil and gas industry is 59. Along with the global

economic slowdown and stock market slump is a rise in the average retirement age. These three impacts—boomers, industry retirees, and economic changes—are all interrelated and impacted by the cyclical nature of the oil and gas industry.

This cyclicality is our industry's hurdle in trying to resolve issues surrounding the employment of top talent going forward. Cyclicality is also the area over which the industry has least control. It is inevitable that the industry will be cyclical because it is based, quite simply, on supply and demand.

Why is cyclicality so important? The answer becomes clear from the perspective of career time spans and talent management. Most employees in the oil and gas industry are responsible for developing a career spanning an average of 35 to 40 years. During the last 40-year time span, there have been seven business cycles. Driven by Wall Street and shareholder interests, the industry has always reacted to these cycles by reducing fixed costs as they would in any downturn in the economy. However, the main element of fixed costs is employee expense. So if the oil and gas industry is driven by quarterly earnings, as are many other industries, then it will respond by driving down fixed costs and therefore, employee costs. This industry will need the brightest and the best to deliver what the world needs, which is energy to drive economic growth. Energy means oil and gas accompanied by great technological advances that require great technical talent. Is the industry ready to attract, train, and—the biggest challenge—*retrain* professionals to step up to the plate? Companies seem to have little difficulty in investing in new technologies and equipment that have long payout times but are reluctant to invest in training that could have immediate results. There are no easy answers.

A look forward to 2025 forecasts an increasing worldwide demand for oil, from 85 million BBLS/day to 115 million BBLS/day. Fossil fuels—oil, natural gas, and coal—make up 86% of the world's energy supply. Matters are complicated by the fact that fossil fuels are under attack by proponents of global warming. Production will have to increase by 30 million BBLS/day in the next 15 years or equivalent substitutes for oil will be necessary. Currently, 98% of transportation fuels come from crude oil, yet production from existing fields is declining anywhere from 10% to 60% depending on the field.

Another contemporary issue is that new supplies of oil and gas are coming from deeper and more difficult formations. The technological challenges in locating, drilling for, and producing hydrocarbons have taken a quantum leap forward in complexity. The 93% of conventional resources that currently exist are owned or controlled by National Governments (NOG) or National Oil Companies (NOC). This leaves only 7% of conventional hydrocarbons, and a large part of the unconventional ones, in play to the highest bidder. Of course, the NOGs and NOCs still require a full suite of technically skilled personnel.

The question arises: What are unconventional hydrocarbons anyway? Put simply, they are either very heavy oils or hydrocarbons held tightly in reservoirs of very low permeability. What new technologies will be required to extract these unconventional hydrocarbons and what training is going to be needed to support these technologies?

Locating and reaching these hydrocarbons requires new technologies in the form of highly sensitive equipment, higher speed processing of seismic data, better software algorithms, electromagnetic field interactions to supplement seismic and visualization techniques—all requiring significant and continuous training investments. The new frontiers of exploration and production will require not only training in those regimes but also new materials and modes of operations to succeed.

The petroleum industry started globalizing in the 1920s. This movement has accelerated in the past two decades and has significantly impacted the types of skills required to succeed. These tend to be the "soft skills" needed in relating to a multicultural workforce and in dealing with NOGs and NOCs.

The immediate challenge today is transmitting the soft and hard skills necessary to quickly bridge the gaps between new and existing personnel. Productivity is an ongoing training concern, both in time to train and time to be trained. Today, training is moving closer to sites of operations—a trend that will only increase as the number of new entrants to the industry increases. Those personnel who might be released for extended periods of time from the worksite to train will be in short supply. To decrease time away and increase productivity at the worksite, travel time must be eliminated or reduced.

New technologies in training are invaluable. Ironically, it is the new generation who invented many of the new multimedia technologies. Fortunately, they are also very comfortable using them. Although online training has existed for some time, in most cases, it has not been very interactive or intuitive. It is therefore necessary to rethink and reposition online training in formats that are familiar to a newer generation of petroleum professionals.

Company trainers and good trainers in general are also in short supply; so as a consequence, training of employees will be done in smaller increments and more frequently, allowing more time on duty. The qualifications for being an effective trainer in the oil and gas industry need to be researched. But if we rely on distributed training, blended learning, and smaller increments of training, how do we track the extent and effectiveness of our training? Learning management systems become important in tracking training effectiveness and e-learning comprehension through testing both written and on-the-job skills application. The whole area of blended learning needs to have a lot of attention paid to it. There is no clearly defined mix of learning modes that gives the greatest outcome.

Companies, government agencies, and society at large demand that training provide competence. It is going to be the joint responsibility of training providers and companies to certify competence. At the end of the day, companies want a measurable return on investment (ROI). They want to achieve a reduction in accidents, an improvement in oil and gas measurement yield, and fewer lost days of production. The measured ROI will require considerable effort to develop a system that can isolate the effects of training on an organization.

Moving forward, the industry will be challenged by its cyclicality of financial results. There will be an intense need to hire the brightest and most technically competent employees to meet the future challenges. The industry cannot afford to be seen as an unstable workplace.

What role if any should the government take in training? I think that there are three things that the government should be prepared to do. The first is to develop a set of best practices from all of training underway in the industry today and communicate them to all of the involved parties. This could include a training reporting system similar to the Financial Reporting System (FRS) that focuses on key metrics for training. The second is audit the effectiveness of training providers. This can be done by testing the personnel that have been trained after they have been on the rig for a period of time. This should be "surprise" testing to determine the retention rate of training. This will do a number of things: it will allow an assessment of the training providers and it will provide metrics to determine the retraining periodicity. This can be done in conjunction with API and the International Association of Drilling Contractors (IADC) who have certification criteria for training providers. The third area is to encourage the industry to fund fundamental research in how to train and retrain the multigenerational work force that exists in industry today. We need to determine the best mix of learning delivery systems that is the most effective in delivering results.

BIOGRAPHY FOR GREG MCCORMACK

Gregory M. McCormack is director of PETEX (Petroleum Extension Service), a continuing education unit of The University of Texas at Austin. He leads the organization's efforts in providing quality education and training to oil and gas industry personnel worldwide. With oversight of expanding facilities in both Austin and Houston, he focuses on continuing business development and workplace excellence in response to the oil industry's growing training demands. Prior to director, McCormack served as PETEX marketing manager in charge of developing the organization's marketing strategy and promoting the unit's mission externally. McCormack's lengthy petroleum industry career has concentrated on midstream and downstream activities of pipelines, refineries, and petrochemicals. For the past six years he has focused his activities on the upstream industry—drilling and production. He frequently trains and gives speeches on the oil and gas industry. He has held positions in business development, operations, strategic planning, budgeting, process control, health and environmental safety; and has directed efforts in North America, Europe, and Asia. He consistently engages research and evaluation teams in studying organizational issues, business needs, and client requirements. He has an MBA, a BASc in chemical engineering, and has advanced management training. Currently based at PETEX's Houston Training Center, he travels frequently to Austin headquarters where publications and training materials are produced and distributed to clients around the world.

His prior work experience included working for Cambridge Energy Research Associates were he focused on clients strategic needs in the oil and gas industry. He also worked for SRI International (Menlo Park) helping to develop new technologies and moving them into the petroleum industry.

DISCUSSION

Chairman BAIRD. Thank you, Mr. McCormack. I thank all the witnesses. You hit the mark on time and much appreciated. I will recognize myself for five minutes and following that we will recognize the members in alternating order.

THE SAFETY OF CURRENT TECHNOLOGIES

Very important and informative testimony, and I want to, if I may use the expression, drill down on a little bit of it here. Dr. Baugh, I was actually a little bit surprised—and I think a lot of people might be surprised—by the statement that you made. Maybe I am not understanding it well, but the current state—and you said it in your written testimony as well: "The current state of technology of subsea drilling systems is completely adequate to provide an appropriate level of safety control of wells being drilled, protect the environment, provide safety to personnel." If that is so, why are we having this hearing?

Dr. BAUGH. Obviously some serious mistakes were made and you have people involved in the system. If I were going to fault the system, it would not be the equipment out there. It is well developed. Sooner or later you are going to have a problem such as the one we have, and we have not done a good enough job of the contingency equipment to go out and capture this spill, but I would suggest to you that the equipment itself is well developed. The downstream systems are not as well developed.

Chairman BAIRD. But there are reports that some of the last line of defense equipment appears to have failed. Now, given the nature of the problem, we don't know exactly why that is. I understand the Deepwater Horizon folks and BP are trying to understand it, but it seems that this was a combination of hardware and human failure. And so the question from me was, if we were to take that quote at face value, it would sort of imply that, hey, there is nothing to worry about. And there is a lot to worry about somewhere, and I am worried when people say we don't have to worry because everything is fine.

Dr. BAUGH. No, I do think you need to worry. We have a good set of equipment out there at this time. At all points in history you need to be continuing to develop better safety systems, keep on doing R&D and look at the next thing. We have not done the next thing, which is basically to say sooner or later you are going to get some kind of a leak and the next one will be different than this one, but we have spent all of our money getting oil out of drilling. We have not done a good job of capturing a potential spill, whether that would be from a tanker or from a pipeline rupture, just a rupture in the earth, a blowout. But I have studied and tried to get all the information I could on this particular incident and I literally have designed every piece of equipment that you are talking about, and the bits of information that are you getting are conflicting. There is something strange that happened here.

Chairman BAIRD. Okay. I appreciate that. That helps me understand where you are coming from.

HUMAN FACTORS OF ERROR

Let me pick up something you said and go to Mr. McCormack. You know, some years ago, right here in this city, there was a tragic aviation accident where an airplane iced up while waiting to take off and went into the Potomac and a lot of lives were lost. Subsequent data and other aviation accidents, FAA looked at a lot of human communication. They realized that you can build the best airplane in the world, but if the people flying it don't operate it according to its specifications, they are going to have a problem. I am curious—and Mr. Pappas, maybe you can address this, Mr. McCormack—what percentage of our research goes into the kind of things Mr. McCormack was saying in terms of how to better train people for RPSEA, and what percentage of it goes to the human factor side? In FAA, they changed the flight deck rules. It had been basically pilot is God, co-pilot is passenger, and if God says, you go. FAA changed that. They are now co-gods in the aircraft, and if one says I don't think it is safe, that person has the career protection for saying so for the best interest of the safety of the passengers. What have we done in the API—any of you want to—I am very interested in this question, because my read of it is that there were hardware physical failures of equipment, but there are also failures to wire it correctly, failures to install it correctly, apparently, and apparently grievous decision differences between BP and Deepwater about how fast to move forward. What do we know about human factors, Mr. Pappas, from RPSEA's perspective? Then we will work on down.

Mr. PAPPAS. All right. I will start. Thank you. We have one project that we have got on our onshore program that considers that. What it is looking at is the combination of smart systems and utilization of new technologies to help people decide when to turn on and turn off equipment, when to move forward and move back. It is a different way of learning, and what we are trying to do is focus it on the onshore program right now, specifically for the unconventional resources. The reason we are doing that is that there are many systems around, but a lot of times they are not compatible with each other. They don't talk well. They don't play well. And the issue is that there are many different companies that develop these things. What we have to do is, we have got to find a way to put them together in a systematic way so that they create a logical response that covers all bases and doesn't make mistakes. So that is what we are looking at specifically in our program.

Chairman BAIRD. Mr. Milito?

Mr. MILITO. I think the point that I would like to make on this is that, you know, when we are looking at this, we are looking at it from a prevention standpoint. You don't even want to get to the blowout preventer, and to that end, what the industry is doing is looking at the best ways to have the procedures in well design in place so you don't have conflicts of opinions on how you design it, so that you have elevated the design of the well and the operating practices to a point where there is no question as to how you are going to do it. You are going to have the barriers in place, you are going to have the casing strings done in a way that is the highest level of performance. So if any of these human factors could poten-

tially arise, they would be resolved already because of the standards in place. So the industry is doing it across the industry to elevate everybody to a point where the standard is at a higher level.

Chairman BAIRD. So if there is a conflict, somebody could say, "I disagree with you, you are violating standard," but what do they do if the person paying their salary insists they violate it?

Mr. MILITO. Well, you know, we are open to a system where those people should be empowered to be able to raise that question, and, if need be, you stop any kind of operations if there is a safety issue. Safety is the priority, and if there is a safety question and there are operations ongoing, there should be an opportunity there to make sure that that does not occur.

Chairman BAIRD. Mr. McCormack, very briefly, because I have exceeded my own time here.

Mr. MCCORMACK. Ninety-eight percent of the operations on a drill rig are very routine. It is the two percent that are not routine. We train towards the technologies. We don't train the soft skills: communication, chain of command. We don't bring the whole team together and train them that way. That really does need to be done. We need to be doing a lot more research in that area. We are doing so little research in training. It is disappointing.

Chairman BAIRD. Thank you very much. I appreciate the witnesses.

Mr. Hall is recognized.

MORE INFORMATION FROM DR. BAUGH

Mr. HALL. Thank you, Mr. Chairman.

Dr. Baugh, you apparently hadn't concluded your presentation. Could you do that? If I am kind enough to give you half of my five minutes. could you do it in that?

Dr. BAUGH. Okay. As a practical matter, the remainder of my presentation is exactly what you said, and you said it more eloquently than I could. You basically said it. I was going to suggest that there are—one thing additional was that there are some specific areas that we should be funding research in, specifically tertiary controls systems for subject BOP stacks and more comprehensive ROV control systems for BOP stacks and upgrading shear ram, shear ram actuators, are specific areas we need to be doing development work in. But other than that, you said it very well.

A DRILLING MORATORIUM

Mr. HALL. I want to go to the court ruling last evening. Last night Secretary Salazar announced that he was going to be issuing a new moratorium that addresses the shortcomings that the court set out, and as knowledge of the causes of the blowout continue to grow, he says a moratorium is going to be proven necessary and just. I don't know how he arrived at that. He is simply going to issue a new one. I don't know how many moratoriums, how many more he has in line to—as fast as the court knocks them down—dig up. But luckily we have the three branches of government and the courts get the last guess at what the law is, whether it is us Congressmen doing it or some bureaucrat, and right now that knocking out the moratorium just looks to me like another step by

this Administration to lessen our dependency on energy that we have here that we know we have here and that we ought to be getting here.

Dr. BAUGH. I do have a suggestion on that. A blanket moratorium, which is what we have right now, is only punitive and does damage to everybody. We need to establish what I would call a rig moratorium, where you shut down every rig at the next convenient stopping point and recertify that rig to pass its FAT test, its systems integration test. And you certify every rig individually, and when a rig certifies that it is good, it is as it is supposed to be, let it go back to work. At that point, you either put people back to work or you put them to work making the rig right, but you have people gainfully employed rather than unemployed.

Mr. HALL. Well, from his statement it is clear that he is convinced that a moratorium is necessary to ensure the safety of drilling operations and protect the environment. Considering the evidence of the spill you have seen thus far and the increased risk posed by a moratorium as you mentioned in your testimony—and I thank you for that—I will ask this question. Is there any scientific or engineering justification you can think of that would also pass muster in a rigorous peer review process that would justify a moratorium?

Dr. BAUGH. I think probably the opposite, because if you presume a moratorium is to determine some greater level of safety that you would like to achieve, you are going to spend six months in a moratorium figuring out what to do, and then you need to tell the good people of south Louisiana that they are going to be out of work for two or three years while you implement whatever it is that justified your having the moratorium in the first place. So I would say that a six-month moratorium is not a credible thing. We are going to have a two- and three-year moratorium if we are going to accomplish something, or we are going to institute best practices, recertify rigs, put them back to work, and then continue to spend money, continue to do development, continue to train better. But, basically, we need to be in the oil business while we are doing this.

Mr. HALL. I have almost—would you like to enlarge any more on your opening statement? I have about 20 seconds left I can give you.

Dr. BAUGH. I think I have said everything I know.

Mr. MILITO. Mr. Hall, if I could add to your discussion on a moratorium, I think we have already seen the Administration take significant action in light of the incident. The first thing they did was they went out and inspected 33 rigs and found only minor infractions. I think you are looking at things like expired eyewash bottles and things like that. And, in addition to that, they came out with a notice to lessees, which outlines the requirements that the operators have to undergo, and they are significant requirements, so steps have been taken to ensure safety. That is called a safety NTL. Measures are being taken, so you wonder why you need a moratorium when the safety measures are being put in place.

Mr. HALL. I don't think that justifies laying off the thousands and thousands of people who are going to be laid off. We are going to lose a workforce that we can't replace.

Mr. MILITO. I agree with you. Some of the economic numbers show hundreds of thousands of jobs at risk here.

Mr. HALL. I yield back. Thank you, Mr. Chairman.

Chairman BAIRD. Thank you, Mr. Hall.

Dr. Lipinski.

INHERENT RISKS

Mr. LIPINSKI. Thank you, Mr. Chairman. I appreciate you holding this hearing. I think we have certainly heard a lot of talk about this disaster in the Gulf, and I am happy that we are having a hearing now where I think we can actually look at some of the issues that we really need to look at instead of just having a lot of heat. Hopefully some light is shed on what happened here and where we should move on in the future.

I really want to focus on what the witnesses think that the—maybe we have to put aside what has happened here. What do you believe is the real risk and the likelihood of such a disaster like this happening? Obviously, you know, some people would say with the disaster that we now see in the Gulf there is no risk worth taking. Obviously there is always going to be a risk no matter what kind of, you know—say we are just looking at energy. With any kind of energy, whether it is exploration or using that energy source, there is always going to be a risk. What do you really think the risk was before this happened of such an accident occurring? Obviously there should be a calculation being made for this type of risk, so would each of you place a percentage on the risk of this occurrence? I don't know if everyone feels that they can, but we will start. If you don't think you can, just let me know that. Mr. Pappas?

Mr. PAPPAS. Thank you, sir. First, I would like to say that, obviously, people didn't recognize this as a risk at all.

Mr. LIPINSKI. I mean, everyone has to say that there is some risk of this happening no matter how small it may be.

Mr. PAPPAS. What I am saying is that it is obvious that the industry did not recognize it beforehand and now they do. Now the industry does. RPSEA as a group is ready to do some work. We have got the people in place to do that. Now, regarding your question, the risk obviously was small but disastrous, and, you know, if you have to put a number on it, is it one in 999,000? I have heard that number before, but I don't have any substantiation. The real problem is that we don't have all the facts right now, so the real question that I would have, that I would turn around and ask, is, do you want to wait until you get more of the facts, or do you want to take a chance on what you know now and decide where you need to go? The question really is a fundamental one.

Mr. LIPINSKI. Dr. Baugh?

Dr. BAUGH. I think there have been something like 4,000 wells drilled in water depths such as this since the last significant spill that we had from drilling, so that would be one chance in 1,000 something like this might happen. But there was—from all the information I have seen, there was really an odd confluence of events, as, for instance, the casing hanger wasn't locked down. Potentially, the casing hanger floated up and blocked the blowout preventers, and it is provided some restriction, but, if that is what

happened, if we do something as simple as make sure that they lock down every casing hanger, this would never happen again. But it is equipment. Equipment does fail occasionally. It would be difficult to say that you are never going to have another spill like this. It would be a shame to say that we have come out of this and we don't have equipment to collect this kind of a spill and take care of it.

I want to assure you that if I had come to you and said a year ago that we need to put $100 million aside to make sure that if a pipeline cracks, if a BOP splits open or whatever happens, that we go out there and be able to suck it up and take it onto vessels and property take care of it—a year ago I would assure each of you would have laughed at me. This year, nobody is laughing. I would like to suggest to you that we end up with $100 million invested in the Gulf of Mexico and in the world because in some place in Southeast Asia or something there is going to be another leak that happens and we need to be able to go down there and vacuum it up, process it, take care of it on the spot, not spend 65 days trying to figure out how to do it.

Mr. LIPINSKI. Mr. Milito.

Mr. MILITO. Yes, I think prior to this event, we have had over 42,000 wells drilled in the Gulf of Mexico, over 2,000 of those in deepwater, and nationwide in the offshore, over 16 billions of oil produced, and, of that, less than 1/1000th of a percent spilled. That being said, the industry understands that there are risks, and over the course of last 80 to 90 years, industry has been working hard to continue to develop the best practices and technologies. Our standards program is continually updating documents. We have recently had a new document come out on isolation of flow zones so that you can manage these types of situations, and we are recommending that be adopted by the government. In addition to that, Dr. Baugh mentioned casing hanger latching. That is something that Interior put in its report that should be done. So what I am getting at is the Administration has taken action on a number of items that should be included in offshore operations to ensure safety, and if these things are done across the board, I think you are minimizing the risk to even lower levels so that we can safely operate.

Mr. LIPINSKI. Mr. McCormack, is there anything you can add?

Mr. MCCORMACK. Usually on a blowout, there are seven to 11 events that occur that lead up to the blowout. Some of them are equipment, some of them are human intervention. We need to make sure that the human intervention succeeds. We need to train the people properly.

Mr. LIPINSKI. But is there a—I know I am out of time here, but I think we need to look at—first of all, is there a calculated level of risk here? And I would assume that if you are engaged in this activity, that any company engaged in this would be calculating for themselves what the level of risk is and what can be done to lower that level of risk. This isn't just something that we look at after an accident, but also beforehand when you are engaged in such an activity. There obviously is a catastrophic failure here and a disaster that no one wants to see, but if we are going to move forward with this drilling, we have to be looking at not only what caused

this, but at each point, where is the risk and where is the possibility potential of that risk calculating all that risk in making a decision? As policymakers, we need to make a decision of what risks we are willing to live with for having such a catastrophe happen again in the future, and I think that is what we should be looking at as we move forward and where in the system—technologically, human factors—how we can really lower this risk.

Chairman BAIRD. Thank you, Dr. Lipinski.

I want to recognize Dr. Ehlers now. Thank you.

SAFETY CONSIDERATIONS AT INDIVIDUAL COMPANIES

Mr. EHLERS. Thank you, Mr. Chairman.

I do not profess to be an expert on anything relating to the oil industry but I did discuss this with someone who I do consider a fairly good expert, and this person went down and spent some time in Houston, talked to a number of the oil executives, people who are experienced in this field of drilling. There is sort of a universal reaction to some of the questions along the line of this could only happen to BP. This is a reflection of the feeling of a number of people in the industry that BP is less careful than most of the other companies that are drilling in the Gulf. I don't know if that is true or not but it brought me up short that you are talking about equipment, you are talking about training. Those are all very important components, absolutely essential components. But are there companies—and I am not going to point a finger a BP because I can't verify that. But are there companies that tend to pay far less attention just as a matter of company policy, either policy neglect or of intention, that pay less attention to safety issues or issues of this sort than other companies do? In other words, are there some good citizens among the companies and some bad citizens? I appreciate any comments anyone could offer.

Dr. BAUGH. I would like to respond to that, if you don't mind. I think one of the problems is that BP has been one of the most aggressive companies. They have gone from not so much here to a lot. If you compare BP to Exxon Mobil, you would think Exxon Mobil is much safer, and I think their actual record is safer, and so there tends to be a thing when you hire new people, you expand, you try to get the people that you can, there tends to be a little bit more of a risky situation, which is one of the primary reasons we would suggest that the moratorium is not a good idea. It sort of puts everybody right back in that mode. But I have personally been on several BP rigs and my general impression of BP has been they have been so anal about safety, it was nauseous. The time it takes to get a permit to breathe on a BP rig, it just drives me crazy. I work with a small company, and we pride ourselves on being quick and responsive. When I go out to a BP rig, I never get the feeling that we have got people that are being dangerous or they are cowboys. I have always gotten the impression that they were very conscious of safety. I think that their real downfalling is they expanded rapidly. They are trying to do a lot of things. Exxon Mobil is very staid, doing the same thing all the time and so they have a good appearance of being very safe but they are very conservative.

And so BP probably has some culture problems. They need to address them. I can assure you they will be addressing them better after this time, but I would not characterize BP as a company which was just reckless. I think you see some individual decisions—people trying to catch up on their schedule, doing some things where people push the envelope some—but I would not characterize BP as just being a bad company.

Mr. EHLERS. Any other comments?

Mr. MCCORMACK. I think what we are seeing is BP did not take the most conservative approach in their operations in the deepwater Gulf compared to other companies, and I think that is a fair statement.

Mr. EHLERS. In your opinion, is that likely to lead at some point to a disaster?

Mr. MCCORMACK. If you cumulatively don't take the most conservative approach and take the most aggressive approach, just building on what Mr. Lipinski says, you are certainly going to increase the risk factor.

POTENTIAL RISKS TAKEN BY BP

Mr. EHLERS. I was also struck recently when 60 Minutes interviewed someone who worked on the rig, and he had an interesting perspective. He related the events that had gone up to it where at various points the BP person in charge had said, this isn't quite right but we have to get this done. Have you heard any verification of that or that type of approach?

Mr. MCCORMACK. What I can say about that is that the BP company man on the rig was a land-based man with very little experience on deepwater rigs. Deepwater rigs have a certain higher risk factor to them. Drilling processes are the same, but the risk factors for failure are much different. You cannot put someone on an exploratory well—which is the first well in that formation and has very unknown activities that are going to occur during the period of drilling—and not have experienced people representing both the company and the drilling.

Mr. EHLERS. Dr. Baugh, you wanted to add something?

Dr. BAUGH. No.

Mr. EHLERS. Any other comments?

I yield back. Thank you.

Chairman BAIRD. Thank you, Dr. Ehlers.

Next on our side is Eddie Bernie Johnson.

DRILLING IN SHALLOWER WATERS

Ms. JOHNSON. Thank you very much, Mr. Chairman.

I need to ask our guest, Mr. McCormack, isn't there drilling between the deepwater that was being done and no drilling at all?

Mr. MCCORMACK. I am sorry. I don't understand the question, Ms. Johnson.

Ms. JOHNSON. Well, this particular incident was one of the deepest drilling in history, I understand. Isn't there other drilling that is not nearly as deep that has been successful?

Mr. MCCORMACK. Oh, the shallow water, which is anything less than 1,000 feet, has been incredibly successful. This is not the

deepest well. They have drilled in 10,000 feet of water and gone down 20,000 feet, so it is a 30,000-foot well. So this is definitely not the deepest, but this is an exploratory well. This is in a new formation that hasn't been drilled into. You can make estimations of core pressure and the temperatures and pressures that you are going to incur on that, but until you drill the well, you don't know exactly what you are going to come across.

Ms. JOHNSON. Has this been deeper in the Gulf of Mexico?

Mr. MCCORMACK. Yes, we drilled deeper in the Gulf of Mexico.

Ms. JOHNSON. If the drilling continues in more shallow water, would all the jobs be lost?

Mr. MILITO. I think—I am sorry. I think part of that has to do with where the oil is. We have been operating in the Gulf for close to 50, maybe 60 years at this point, and we are really picking over bones and having to go out in these deeper waters where we are allowed to get it, where there has essentially been a moratorium in place off the Pacific and Atlantic coasts. So there is a lot of oil in the deeper waters. The companies are able to find it there and it makes business sense to go out there and develop it, because that is where it is.

Ms. JOHNSON. Are there any——

Dr. BAUGH. Excuse me. Could I address that?

Ms. JOHNSON. Yes.

Dr. BAUGH. You are really, I think, asking, is there a safer place to drill and a not-so-safe place to drill, and probably the distinction you are looking for is development drilling and exploratory drilling. Development drilling means they have already drilled into a formation and have a good idea of what is there and so they are just drilling more wells for production. Exploratory means you are drilling in, you don't know quite what is there and you may hit a high-pressure pocket, and a compromise you may be looking at a short term is to allow people to continue drilling, but to do development drilling so that they are producing more oil and basically have a moratorium more along the idea of doing exploratory drilling where you are drilling into unknown formations.

Ms. JOHNSON. Yes?

Mr. PAPPAS. Short comment. Shallower wells closer to the coast are typically gas producers these days and not oil producers, as was mentioned. Most of the oil has been pulled from those wells.

ACCIDENT PREVENTION

Ms. JOHNSON. Anyone can answer this for me. What would you suggest that needs to be done to avoid this type of accident? I know there is not a perfect situation where you can predict that it will never happen again but what improvements would have made a difference in this incident?

Mr. PAPPAS. May I, Representative Johnson?

Ms. JOHNSON. Yes.

Mr. PAPPAS. As I mentioned earlier, RPSEA has a group of over 700 subject-matter experts in the oil and gas business and they run the gamut from environmental and energy companies, vendors, research universities and interested parties, other interested parties. These experts are the people that we should ask that question of. It should not, in my opinion, be the decision of just a single group

of people that have a dog in the fight. They all have to have different opinions and we need to put those all together. In my estimation, we need to put this group together and a group like RPSEA is one of those that is excellent at putting these diverse groups of people together. If we could do that and utilize the process that we have in place, it won't take very much time at all. We can come up with a distinctive list of technologies that need to be looked at and technologies that are already in place, whether they be state-of-the-art or accepted already to see which direction we need to go.

Ms. JOHNSON. Anyone else?

Mr. MCCORMACK. Representative Johnson, all blowouts can be prevented. There are signs that a kick—meaning oil and gas—is entering the well bore when you don't want it to be there. There are signs ahead of time. The problem when you are drilling this deep is, the amount of time that you have to react is shortened, so you have to be able to recognize and respond much quicker. But all blowouts can be prevented.

Ms. JOHNSON. Thank you very much. My time is expired, Mr. Chairman.

Chairman BAIRD. Thank you, Ms. Johnson.

I have got Mr. Bartlett—Dr. Bartlett.

RESPONSIBILITIES OF THE PERMITTERS

Mr. BARTLETT. Thank you very much.

Several days after the blowout, the *Wall Street Journal* had a fairly long article, kind of a moment-by-moment story of what was happening. I was struck with how detailed the permitting process was. It would seemed to me they could hardly tighten a screw without going to the regulators to say is it okay for us to do this. It seems to me there was a very meticulous procedure for making sure that the regulators knew everything they were doing. Was there any time during these procedures that the regulators said hey, guys, aren't we cutting a few too many corners? Did that kind of an inquiry ever happen? It wasn't in the story. There was no indication in the story in the *Wall Street Journal* that that ever happened.

The reason I am asking this question is that if you are subject to meticulous regulation, isn't there a shared guilt here if in fact there is some guilt? Isn't there a shared guilt here? If BP couldn't make a move without getting permission from the regulators, why is 100 percent of the blame placed on BP here? Help me understand that.

Mr. MCCORMACK. Mr. Bartlett, the inspector for the MMS had just come over four months ago from a production platform. Platforms are completely different than drilling platforms, so we had basically a very inexperienced inspector from MMS making some of these decisions.

Mr. BARTLETT. My concern is that, you know, everybody did what they thought was the right thing here and we end up—there were two entities involved in it. Clearly there is a very tight partnership here between the drilling people and the regulators because I was struck with how frequently the drilling people had to go to the regulators, hey, is it okay for us to just change the size of a pipe, for

instance, they have to go and say is it okay to do this, and the answer is yes, it is okay to do that. So my question is, why do you think that we are assigning 100 percent of the blame to BP and the regulators are never, ever mentioned as being complicit in this problem? Yes, sir.

Mr. PAPPAS. Representative Bartlett, I will just give you my personal experience. From the times I worked offshore, the Minerals Management Service representatives were very professional, and, in some cases, were a real pain in the neck for me. It was because they had such stringent requirements and we had to follow everything, and the relationship that I developed with those people on a personal basis was purely professional and I understood that they had a job to do, and that is the way I took it.

Now, that being said, my understanding is that BP is being pinpointed because they are the operator of record and that that is the law. Besides that, I am not sure I could help you.

Mr. BARTLETT. But if they couldn't move without getting permission from the regulators, why isn't there some shared responsibility here? There is clearly shared responsibility. I just don't see that noted in the press.

LIMITED REMAINING OIL RESOURCES

Mr. Milito, you mentioned that we have now produced, what was it, 16 billion barrels of oil from Gulf drilling. Is that the number?

Mr. MILITO. The 16 billion is offshore development for domestic production activities.

Mr. BARTLETT. Sixteen billion?

Mr. MILITO. And I would assume that, you know, 90-some percent of that is from the Gulf of Mexico, because that is really the only area that we have access to at this point. There is some production off the coast of California.

Mr. BARTLETT. It is kind of interesting to put this problem in some perspective. That 16 billion barrels of oil will last the world 192 days. Every 12 days we use a billion barrels of oil. I think the significance of that escapes most people. Every day we use 84 million barrels of oil. Check my arithmetic. I think 84 goes into a thousand roughly a dozen times. Doesn't that mean that every 12 days we use a billion barrels of oil? So we find a huge reserve out there, 10 billion barrels of oil, and we heave a sigh of relief, gee, guys, no problem now, we have got plenty of oil. That will last 120 days. Do you think there should be a broader recognition of the role that the trifling amounts of oil that are yet to be found compared with what we are using?

Mr. MILITO. In terms of that there is a small amount yet to be found or that——

Mr. BARTLETT. Well, I don't think that there is a whole lot yet to be found, and we use a billion barrels of oil every 12 days. You find 10 billion barrels of oil, that is a big find, that will last the world 120 days. Big deal. My time is up. But I just think it is important to put this in context.

And you really need to ask the question, do you think it is worth the question? I have 10 kids, 17 grandkids and two great-grandkids. We are leaving them a huge debt. I would like to leave them a little oil. Is that okay? Thank you very much.

Chairman BAIRD. Thank you, Dr. Bartlett.

Mr. Tonko.

Mr. TONKO. Thank you, Mr. Chairman. I just have to respond to that last question. I agree with the sentiment. It is time for us to begin to explore new alternatives and renewable opportunities because of the limitations that face us.

FUNDING FOR RESEARCH AND SAFETY

With that being said, Mr. Pappas, in your work with the Research Partnership to Secure Energy for America, how much of the research funding would you say has been focused toward extracting technologies as compared to safety technologies?

Mr. PAPPAS. That is a really good question, and I would say that eight of the 71 projects that we have are specific to environmental and safety side of the business, but every one of those projects has a component of environmental and safety to them. So small parts of every project, but eight are specific to environmental and/or safety concerns.

Mr. TONKO. And with the growth of investment in technology, there seems to be an indication that, in reports from as much as 10 or 15 years ago, there were recommendations to invest much more heavily in technology. But then we see situations like that of, I believe it was May 2008, where an exemption was granted to BP where a valve that perhaps could have been utilized that cost a half a million dollars could have avoided tens of billions of dollars of impact here. How would you characterize the exemption? Would it be because of overreach, or is it because of being deemed unnecessary or duplicative? What would technology explain is a reason for exempting a company like BP from that requirement?

Mr. MCCORMACK. Maybe I can answer that. I think what you are talking about is an acoustic switch that you can operate from the surface to close the blowout preventers. The blowout preventers failed and an acoustic switch would not have been able to actuate the blowout preventers. So in this case, it would not have helped. In other cases it might help.

Mr. MILITO. If I can add to that, my understanding is all the rigs operating do have secondary means of shutting down the well and the blowout preventer. There may not be a requirement that they do have that. But with regard to an acoustic regulator, there are some concerns about posing other risks, and in deepwater there are concerns about regulators being triggered by things like vessels passing by. What is being recommended by the industry as we look at that type of equipment and technology to see where it would be most appropriate to include that because we don't want to be increasing risk when we are trying to improve safety.

Mr. TONKO. Okay. So with those increased risks or some of the awkwardness of utilizing that technology, why wasn't there a more aggressive approach to come up with the technology that would avoid all of that potential impact and have something that was streamlined and directed to do what it needed to do?

Mr. MILITO. Well, as I was saying, I think most every rig has a dead-man shutoff, which means when there is a separation in the riser from the BOP, that you are supposed to have an automatic shutoff, or, if there is a disconnect between communication from

the BOP and the rig floor, you are supposed to be able to have an automatic shutoff. This gets to what Mr. McCormack was talking about. The BOP wasn't functioning so it wasn't how you control it. We really need to see the final results of the investigation to see why that thing didn't shut down.

Mr. TONKO. Thank you, Mr. Chair. I have no further questions.

Chairman BAIRD. Thank you, Mr. Tonko.

Mr. Rohrabacher.

SUPPORT FOR SAFETY MECHANISMS

Mr. ROHRABACHER. Thank you very much, Mr. Chairman, and let me note that I agree with Dr. Bartlett's analysis that we should be developing alternatives to our dependence on oil and gas right now, and I would suggest, however, that we cannot do that at the expense of not doing the research and development of technologies that we need to make sure that our current structure is safe, and I would suggest that that is exactly what has been going on here in that we have, for example, last year the Department of Agriculture alone, their spending on basically global warming money—pardon me for bringing that up again—was 16 percent higher than all of the research and development in the DOE in terms of oil and gas. So just the money spent by the Department of Agriculture on global warming research was basically 16 percent higher than what we spent trying to make our own oil and gas safer. That is a false priority. I mean, yes, we have to prepare for the future but you don't prepare for the future in a way that you have a greater emphasis than making sure that what you are doing today is safe, and apparently that is what has been going on, and I have been told that DOE fossil fuel research programs, that the DOE in their fossil fuel research programs, they are moving almost entirely towards the issues of capturing and storage of carbon rather than safety and rather than trying to see how we can produce more oil and gas in a safer way. Again, that is a false priority based on this concept of global warming that I think has been misdirecting our resources.

Let me just ask a question here. From what you have seen in this catastrophe that we have had down in the Gulf, were there—were all of the standards and accepted procedures, were they being followed or can we say that this tragedy is a result of not following accepted standards and accepted procedures?

Mr. MILITO. I think at this point we really have to wait to see the root cause analysis that comes out of the investigation. We are hearing a lot of reports in the media, and there is some talk about well design and operating procedures, but we really do have to wait. That being said, the industry did put together several task forces, including two on equipment and operating procedures. Putting this incident aside, they looked across to see what is being done at a higher level to——

Mr. ROHRABACHER. Well, we have standards in place, and Mr. McCormack has made it clear that had we had everything going the right way and doing what was sulfur dioxide to have happened, this would not have been a catastrophe. So I am assuming that the standards and the procedures were not being followed, and I understand, for example, safety equipment was not maintained. Is there

anybody who understands that? Some of the safety equipment that should have gone into place like you say, it should have functioned that were not maintained properly? Batteries were not present and things like that.

Mr. PAPPAS. I will say that one of the things that I had heard is that the blowout preventer had some of the valves that had been changed over and there is a possibility that they may not have been properly inspected by a professional engineer. That is entirely possible. We will have to wait and see and wait for the root cause.

Mr. ROHRABACHER. Well, let us just note that there is risk in any endeavor. I mean, I fly an airplane every week and sometimes there are airplane crashes, but we recognize that people have high standards, and as the Chairman pointed out, a change in standards for airlines that made it safer for us. We must pay attention to training and standards and make sure that we have a very high level of commitment to that, and perhaps again, there may not have been the commitment to this in British Petroleum as in some of the other companies and that may have been one of the reasons, and so—but whenever we have any endeavor, there is going to be risk involved and actually minimizing the risk is part of their job but also it is part of our job, Mr. Chairman, and what I am suggesting is that we have not even in Congress done our part because we have had our priorities shifted way and money being spent on things that should have had less priority than making sure that our current dependence was on equipment and technologies that were reliable.

So with that said, thank you very much, Mr. Chairman, and let me congratulate you, Mr. Chairman. This is an excellent panel and you have done a great job of leadership in this issue, and I respect that.

Chairman BAIRD. Thank you. While my colleagues are all here, I hope we can get a CODEL, another trip down to the Gulf area. I was just there this weekend. Some of you came after I mentioned that. We are going to try to get another trip down there to see firsthand the work that is being done, so we will try to give you advance notice on that.

Mr. Luján.

HOW TO HALT THE DEEPWATER HORIZON SPILL

Mr. LUJÁN. Mr. Chairman, thank you very much, and before I begin my questioning, Mr. Chairman, I want to submit an article to the record from the *Los Alamos Monitor* that highlights two individuals that have come up with what appears to be a simple idea, as well. I know that, as we are looking to make sure that we have a vehicle to be able to accept some of these thoughts and ideas for true vetting, that this is one that we want to make sure that we get a close look at. So if there is no objection, Mr. Chairman, I would ask permission to submit this into the record.

[The information follows:]

Quick fix for BP oil disaster could come from LANL

By Carol A. Clark

Los Alamos Monitor

June 9, 2010

Thousands of suggestions are pouring into the U.S. government about how to plug the disastrous BP oil leak that's been spewing an estimated 1 million gallons into the Gulf of Mexico daily since April 20. Local engineers and a principal developer from Chicago are confident they have the solution to halt that leak within a day or so and are attempting to get the decision makers' attention.

"What we're trying to do is solve an awful problem and the sooner it gets solved the better," said mechanical engineer Don Brown who worked at Los Alamos National Laboratory from 1959-2001 and is currently a LANL guest scientist. "Our solution is nothing fancy — it's all stuff you can buy off the shelf but it's backed by nearly two decades of research and testing. They just need to load it onto a boat and run it out to the site of the leak and get it sealed up within the day."

Physicist Arun S. Wagh, Ph.D., retired from Argonne National Laboratory near Chicago in 2009 and is credited with leading the project that developed the material called Ceramicrete.

Ceramicrete bonds to itself, sets under water, is drillable and bonds to steel and rock and other earth materials.

The impetus to work on Ceramicrete was the Hot Dry Rock project at Fenton Hill at LANL's Technical Area 57 in the Jemez Mountains, Brown said.

"We gave our suggestion to Don O'Sullivan, a LANL scientist who intends to send it forward to a group appointed by DOE Secretary Steven Chu to look into solutions to this crisis," Brown said during an interview Monday. "I also posted our solution on the BP Web site this morning in the hopes that it catches somebody's attention that has authority to act on it."

Whether that somebody is from the U.S. government or the London-based oil giant is irrelevant so long as somebody takes advantage of this relatively simple fix, he said.

"The Ceramicrete development project received $8 million in funding from DOE," Wagh said during an interview from Chicago Monday. "It also won the R&D 100 award in 1996 and 2004 among many other awards. There are 19 patents on Ceramicrete, two of which are oil field related and one of those two are shared with LANL."

Sealing the BP oil leak between the Lower Marine Riser Package (LMRP), commonly called Top Hat, and the Riser pipe with rapid-setting phosphate cements is what Wagh and Brown are proposing.

There is a consensus that even if the LMRP works, there will still be a leak of oil in the gulf, Wagh said, adding that the relief wells will not be ready for about two months. This timetable can be threatened by tropical storms and hurricanes and as a result, the total amount of leak at the end can be considerable.

"There is a need to plug the leak between the Top Hat and the Riser pipe completely," he said. "We propose a method of achieving a good seal using Ceramicrete."

Initiated by funding from Exxon-Mobil, BP-Amoco, Shell and Chevron, novel acid-base phosphate cements were developed for oil field applications by Wagh and Brown prior to DOE funding. Some of which was in collaboration with the University of Alaska, Halliburton and BJ Services, resulting in a full development of phosphate cements for a range of applications in oil fields, Wagh said.

These novel cements are produced by mixing two components, one mildly acidic (pH = 4.2) phosphate slurry and an alkaline (pH= 9-11) oxide or oxide mineral slurry. When brought together, the exothermic reaction between the acid and alkaline components sets the mixture rapidly into hard cement, he said.

The advantages over Portland cement include:

• Ceramicrete exhibits twice the strength of Portland cement and forms good seals even in the presence of high hydrostatic pressure;

• It expands slightly during setting and thus forms a tight seal;

• Its acid-base cement reactions are exothermic, generate heat and counteract against forming gas hydrate crystals;

• Reaction and setting rates can be tailored from permafrost conditions (32 oF) to warm temperatures (200 oF);

• Bond to steel and formation with chemical as well as physical bond;

• Do not need fresh water for mixing — can use seawater;

• Density of the components and set cements are nearly the same as that of Portland cement, but can be adjusted to desired densities if needed using fillers. This allows one to use same equipment and engineering parameters as those used in conventional cement pumping;

• The acid-base mixed slurry is thixotropic and does not set when it is in motion. It sets rapidly once it is static; and

• The components have moderate pH and hence are safe to marine life — set cement is neutral in pH.

Wagh and Brown explained their plan to stop the leak saying the acidic and alkaline slurries are fed by a dual wall drill pipe used to pump both streams in the same direction with a high but controlled pressure to counteract the pressure of the upcoming oil.

Dual wall drill pipe is currently used in the oil field for reverse circulation and they are available off-shelf. The pipe is fitted on the bottom with a single wall pipe that can be used as the mixing chamber for the acidic and alkaline streams.

The single wall pipe has a dispensing hole at the other end from which the mixed slurry may be pumped out against the up-thrust of the crude oil moving in the upward direction.

The flow rate and injection pressure of each slurry stream can be controlled at the surface to produce the desired down-hole extrusion over-pressure, Wagh said. Once dispensed, the mixed slurry will slow down and move upward with the crude oil around the mixing chamber and the dispensing pipe.

"Since it is now in contact with the hot crude oil, its setting will accelerate and while moving in the upward direction, it will start setting," Brown said. "It will set in the region below the conical shape of the Top Hat and the leaking joint between the Top Hat and the cut rim of the riser, all the way to the dispensing level. The bonding between the cement and the walls of the Top Hat and the Riser pipe will be intimate because the cement bonds to steel very tightly."

Once the leak stops, the dispensing pipe and the mixing chamber may be withdrawn with some force, he said. Drilling through it may clear the set cement in the riser and production can be resumed. Setting characteristics of the acid-base cement, it's bonding to steel, the use of dual pumps and the end properties of the set cement have been well studied in various applications, Wagh said

With the U.S. government no longer relying on BP for estimates on how much oil is leaking into the gulf, it's difficult to know just how devastating this catastrophe will become.

Flow rates calculated by the U.S. government will help determine penalties leveled against BP based on how much oil has been spilled, according to White House press secretary Robert Gibbs during a briefing Monday.

Prior to meeting with President Barack Obama and cabinet members at the White House Monday, Coast Guard Adm. Thad Allen said the cap placed on the damaged oil well over the weekend is collecting 462,000 gallons a day. Federal officials estimate that the ruptured pipe is gushing as much as a million gallons of oil a day and according to Allen, could take years to clean up.

Time is of the essence to seal this leak, Brown said.

Chairman BAIRD. Okay.

MONITORING AND DIAGNOSTIC CAPABILITIES AND COORDINATION

Mr. LUJÁN. Mr. Pappas, given the events in the Gulf, it has become apparent there is a need for new diagnostics and technology to monitor the state of the deep-sea wells and their safety equipment. The more we know about the wells deep under the ocean—its pressure, its flow rate, its composition, whether we are talking about gas, fluid or mud—and the more we know about the state of safety equipment is important such as the blowout preventer, the better we will be able to prevent accidents and the more we will be able to deal with accidents should they occur. There are DOE

entities right now and brain trusts that are private and public that are engaging in diagnostic activity as we speak. Do you agree that there is a need to develop improved diagnostics, and if so, what diagnostics are most urgently needed?

Mr. PAPPAS. Thank you. Representative Luján, I think that we are moving in the right direction. Unfortunately, it is for the wrong reasons because of what has happened, but the notice to lessees that came out had some excellent, excellent recommendations to improve systems just to start with. I believe what we need to do is we need to dissect the issue, dissect it into its components and take a look at it, and then see how it gets put back together into a system. We need to get those experts together to formulate where we need to go. Obviously, communications is an issue. Obviously, training is an issue, as was mentioned earlier. Hardware is probably going to be an issue, not necessarily because it—it may be that it is adequate for right now, but will it be adequate in the future since we continue to move into deeper and harsher environments in both gas and oil drilling? We all know that we need that as a bridge to get us to the next generation of energy. So, to start with, that is where we need to go.

The programs that I outlined a little while ago I think are focused on the environment and on the safety issues, but every one of these components, I think, needs to be looked at from the environmental impact side and also from the safety side.

Mr. LUJÁN. And with that being said, Mr. Pappas, how might RPSEA be better integrated with DOE's drilling research activities as well?

Mr. PAPPAS. Yes. You know, we work very, very closely with the Department of Energy. We have meetings from time to time. We try to keep in touch. They have a complementary program through NETL that works with us very closely. So we are moving in that direction. One of the problems that we have is that money that was authorized was $100 million, but only $50 million was appropriated, and as I mentioned, we have other projects that could have taken priority. And then in addition to that, what we have uncovered because of this recent catastrophe is that we could probably utilize another $100 million, and we probably still wouldn't have enough.

Mr. LUJÁN. Mr. Milito, if we wanted to set up a focused, quick response DOE partnership with some of the efforts that we see underway now, a program to develop new safety diagnostics of deployment as soon as possible, do you have thoughts on if the Office of Fossil Energy or ARPA–E would be a better location for partnerships and collaborations that you are engaged with now?

Mr. MILITO. Yes, it certainly should be something that we need to consider. We have to make sure that all the agencies that are doing the research are coordinating and collaborating with what the industry is doing. It is an effort that Congress, the Administration, Department of Energy, Department of Interior, and the trade associations need to work together on. So, if there is a way to manage that and have the coordination, we should have that discussion and make sure it happens because a lot of ideas are being generated. We are providing them to Interior, but if Energy is going

to play a significant role here, as it should, then we have to make sure that that discussion is held.

Mr. LUJÁN. And is API currently engaged with the evaluation of diagnostics to see what we can be doing better based on what we know is occurring around the Gulf that we should be expecting to see in some of the reports soon to be released?

Mr. MILITO. Some of the recommendations that have come out from the industry have to do with the blowout preventers and the remote operated vehicles, and a lot of those recommendations concern testing that has to be done at the rig level as well as underneath the water. So we are moving forward with changes to the standards on BOPs and ROVs to address some of those issues, so that is occurring.

Mr. LUJÁN. And any thoughts on how we might be able to better integrate with the DOE drilling research activities?

Mr. MILITO. Same thing. We just have to have an open dialogue and make sure that—and our standard-setting process is open to the government. David Miller, our standards director, is here, so we can make sure that we have an opportunity to have them as a participant or an observer, however DOE thinks that they would best fit in.

Mr. LUJÁN. I appreciate that.

And Mr. Chairman, I know we didn't have time to get——

Mr. PAPPAS. Mr. Luján, could I add something very quickly?

Mr. LUJÁN. Mr. Pappas.

Mr. PAPPAS. One of the things that I see is that the function of government—and the Department of Energy in particular—is to look at the fundamental type of research. When it gets into application, it is probably best left to people that are little bit closer to the industry. Now, the oversight may continue to be from the government level, but I believe that the subject-matter experts sit down in Houston and offshore and in New Orleans and so forth, and those are the folks that we need to ask to get to applications so that we can utilize what we best need. Thank you.

Mr. LUJÁN. And Mr. Chairman, maybe along those lines, there are existing entrepreneurial lead programs that exist at the labs to work with small business startups. There may be a lead program along the lines where you can work and you can integrate these activities to best make sure that we are accelerating them. Thank you, Mr. Chairman.

Chairman BAIRD. Mr. Garamendi.

MORE ON ACTIVITIES COORDINATION

Mr. GARAMENDI. Thank you, Mr. Chairman. I am going to follow up on some of the questions that Mr. Luján had raised. Specifically, I want to go to the moratorium. A lot of discussion going on around here and perhaps in other places, I guess also in a Federal court about moratoriums. When the military in 2008 lost two T–38 trainers, jet fighter trainers, the Air Force stood down until they could figure out what is going on. The moratorium should be the same purpose. We have had a horrendous problem. Why did it occur? What are the elements of it? A moratorium in my view is absolutely necessary until we find out what goes on and what has gone

on. You have described the difference between development and exploration. Understood.

My specific question is, what is the industry doing in coordination with the Department of Interior on standards and procedures including both the oversight of the government and the policy procedures and equipment that is to be used in the exploratory processes?

Mr. MILITO. When we put together the task forces on equipment and operating procedures, this was shortly after Secretary Salazar had a meeting with the exploration and production presidents and vice presidents, quickly assembled them and quickly started having a dialogue with Interior. Those task forces really came up with three buckets of recommendations that went to Interior. There are 22 recommendations. The first bucket has a lot to do with a lot of the discussion we have had. It has to do with risk management and making sure that the drilling contractors have a safety program in place, making sure that the operators have a safety program in place and making sure those two programs are talking. And then there is a recommendation that has to do with operating procedures, making sure you have the appropriate barriers underneath the wellhead to ensure that hydrocarbons cannot breach the well, and then making sure you have the right interfacing between BOPs, ROVs, and making sure that you have sharability. All those technical recommendations have been made. Sixteen of the 22 were accepted by Interior in its report, and then some of the other work. We have a recommended practice in isolating flow zones for drilling operations. We have recommended that it gets adopted and we are moving forward with working, improving our standards on BOPs and ROVs. So there is a lot going on and they are not stopping the work. They are going to continue to work in the long term.

Mr. GARAMENDI. To wrap up this one question, it just seems to me absolutely essential that, before we continue to do deepwater exploration, we have all of those procedures in place, including the oversight, review, and appropriate role of the Department of Interior's new organizational structure. Until that happens, we ought not do any more exploration. As to development, that is another question. The same things would apply. I think there would probably be different kinds of requirements.

OIL SPILL RESPONSE PROGRAMS

The next question, I think, Dr. Baugh, you raised this point. I want to go to it. In California, we have had since 1990 a very sophisticated oil spill response program. It does have in-place funding. It does have in-place materials, communication programs located in southern California, northern California, I think also in the central coast of California. Does such a program exist in the Gulf, and if so, is it—obviously it is not sufficient. What would you do to make it better? A hundred million dollars was a number that you came up with a moment ago.

Dr. BAUGH. That number came out of thin air, for what it is worth.

Mr. GARAMENDI. It sounds——

Dr. BAUGH. There are——

Mr. GARAMENDI. —on track.

Dr. BAUGH. You saw a lot of booms deployed in the Gulf of Mexico, which says there is a lot of response capability in the Gulf of Mexico, but I would suggest to you that we should not be sitting at the surface letting oil come to the surface, come to the beaches, and then try to collect it. We need to go to the site of the spill and we need to vacuum it up and take care of it there and not let it pollute the beaches.

Mr. GARAMENDI. My question doesn't go to how we do it, but is there is—obviously there is not a sufficient program in place. The program in California is funded by the industry, both the transportation industry as well as the development industry. And it seems to me we must have such a program everywhere oil is drilled and developed and explored. Otherwise we are going to be left with wondering how are we going to deal with this. A question for all of you: Would the industry support such a robust program in the Gulf area?

Dr. BAUGH. I think the problem is that individual companies have difficulty taking care of these systems. This is something that the Federal Government, MMS, should be very much involved in and directing, but literally it may well be that you could get a high response characteristic out of—do you know what a cold tubing unit is? Basically, it is a rig which has three and a half inch pipe you roll up like a hose, but it could be very small, very portable to be able to do a lot of things, and it could be here. It could go to California and do a lot of things, but there is a next generation of capability that needs to be done that is just not there, and MMS would be the appropriate people to take a lead in that.

Mr. MILITO. Congressman, if I could add to that, the industry does support a robust program in the Gulf of Mexico. In fact, I think a lot of the activities that you see occurring are being occurred by the OSROs, the oil spill response organizations. Those are funded by the industry. And if there are improvements to be made, we need to make them.

Mr. GARAMENDI. Mr. Chairman, I would recommend that legislation forthcoming deal specifically with this. California is a model, perhaps not the best. There may be other models around the United States and around the world but we really must have in the Gulf and other places where oil is produced in the marine environment a very robust, ready-to-go program in place to deal with all the eventualities, whether it is shallow drilling, tanker, pipes or deepwater drilling. It does not appear to have existed previously or to exist presently in the Gulf, and we need to do that.

A POTENTIAL MORATORIUM ON WEST COAST DEEPWATER DRILLING

My final point is just very, very quick, and that is, I am the author of a ban on deepwater drilling, new leases off the West Coast. I think it is absolutely essential. There is a lot of talk about "well, we are going to need oil." It is in fact true that several, well, two to three billion barrels of oil off the coast of California in California waters could be accessed from the shore, and, in fact, you can get into Federal waters, nine miles now, with directional drilling. You don't need to be in the marine environment with all of the all too obvious hazards associated with marine environment. And so we

ought to think about that. However, Mr. Bartlett is quite correct. We have to move beyond oil, and that is the fundamental policy, Mr. Rohrabacher. That is the fundamental policy we ought to be pursuing.

Thank you very much, Mr. Chairman.

Mr. BAIRD. Thank you, Mr. Garamendi.

Mr. Carnahan is next. Thank you.

BLIND SHEAR RAMS

Mr. CARNAHAN. Thank you, Mr. Chairman and our Ranking Member, for calling this important and timely hearing on how we can make improvements to technology.

I wanted to start really my first question with Dr. Baugh. We have seen many studies over the last decade that have questioned the strength and reliability of the blind shear rams in terms of again their—they suggest, you know, many of them do not function properly and, in fact, Transocean indicated that 11 of its 14 rigs in the Gulf have two blind shear rams. I guess my question is, do you believe every blowout preventer should have two in terms of backup, but, also, are there things that can be done to improve the reliability, as well?

Dr. BAUGH. I would have a personal preference for dual blind shears on every BOP stack. It becomes a single point of failure, and you would like to have no more single points of failure than practical. It will take a while to put them on there, and I think all industry needs to be moving in that direction. There are things that can be done to improve the ability to shear. We have a very small company, but we have an intensive research program and we are personally working on ways to improve how you would shear drill pipe and potentially shear drill collars that are in the well. But there not only needs to be an upgrade of the ability to shear and shear reliably, but also there are times when you are going to put equipment in front of the shear rams that cannot be sheared, period, and you need to—we potentially need procedure so that, whenever you are going to put something in front of the shear rams that cannot be sheared, you would know it. So potentially you stop and you wait five minutes and see if you get any flow of oil but check your returns to make sure there is nothing coming in from the formation before you put something in front of the rams. So I think we need procedure and equipment upgrades in this area.

Mr. CARNAHAN. And any others on the panel that want to comment on that, please?

Mr. PAPPAS. I will. I would say that API recommended practice 17–N addresses the reliability for subsea equipment, and if we can utilize that to determine if additional improvements need to be made of any sort that we should take advantage of that.

Mr. CARNAHAN. Do you think some of the data that suggests that the blind shear rams could only be counted on to fully activate about half of the time, is that consistent with data you have seen?

Mr. PAPPAS. That is true.

Mr. CARNAHAN. Any others?

Mr. MCCORMACK. Yes, I think the reason for having two blind shear rams is that it is very difficult to shear the tool joint, which is the joint between the drill pipes. So if you have them four feet

apart, if one is on the drill tool joint, the other will be on the pipe, and it is much easier to shear that. The problem, though, if you had the drill collar, which is the heavy part of the drill stem in the blowout preventer, it is almost impossible to shear that.

MORE ON RESEARCH FUNDING

Mr. CARNAHAN. Let me go on to the second question I have that really has to do with how additional research can be paid for. Certainly the industry has devoted billions of dollars for research, but it has largely focused on ways to increase production, not so much devoted to accident prevention and mitigation. So I guess my first question is, how do we have a more balanced mix toward that? And the other is, I guess models of how other countries are paying for this kind of research with regard to royalties, lease fees, and how that needs to be better put to use, particularly at a time in recent years when we have seen oftentimes record profits being reported from several companies in the industry. Let me start with Mr. Milito and we will go on from there.

Mr. MILITO. Recent information from the National Science Foundation shows just what you have said, that there are $200-plus billion spent in 2008 on R&D among the $300 billion in capital expenditures in the industry. While a lot of that is spent on production capabilities, when you are looking at, you know, BOPs and drill ships and things like that, you are building those and designing them to have safety components embedded in the process. Along with that, the industry as a whole is working on best practices which provide the safety mechanisms to be in place as we move forward. That said, in the wake of this incident we have to look at everything. We have to look at the opportunities and the needs to do further research to make sure that we are operating in a safe manner, so it is something we have to consider.

Mr. CARNAHAN. Mr. Pappas.

Mr. PAPPAS. Thank you. You know, the European Union basically spends two percent of what it gets out of the ground basically and turns it back into R&D. The United States doesn't do anything near that. We have such a small percentage. From my understanding, royalties that the U.S. government retains is the second largest revenue producer after the IRS. We know that that money isn't being reverted back to R&D in the energy industry, and in my opinion, it needs to be because it is a priority. It is definitely a priority.

Mr. CARNAHAN. Excuse me. Do you know what our percentage is? You said it is way under two percent.

Mr. PAPPAS. I think it is 2/100ths of a percent in the oil and gas business or something like that. So that is one point that I would make.

The second point has to do with what percentage to put into safety and environment versus ongoing productivity. In my opinion, you need to have a healthy percentage, ten to 15 percent probably should be at the very least. When you have an issue like this, you need to throw a lot more at it and you need to throw it at it very quickly, not because you want a quick answer, but because you want the right answer soon.

And the third question, if I am not mistaken, had to do with how we fund this stuff and why the government should fund more versus private companies. Private and public companies basically answer to their stakeholders and their stockholders, and what they look at is they look at R&D and technology development as it relates to economics for them, and that is a capitalist society that we are in. What the government needs to do is, they need to assist us to move on beyond that, to look at things that may not be economically viable as we see right now, and lo and behold, we may learn something that may actually open up some doors and it may actually improve it for everybody.

Mr. CARNAHAN. Any others on the panel?

If not, thank you, Mr. Chairman. I yield back.

Chairman BAIRD. Thanks, Mr. Carnahan. To my colleagues, we have been informed that we expect votes to start any moment now. Mr. Hall has notified me he has a brief question he wants to follow up. I have one brief one, and then unless there are other burning issues——

Mr. ROHRABACHER. Mr. Chairman, I have just one very brief thing.

Chairman BAIRD. Well, how about we recognize Mr. Hall first and then I will recognize Mr. Rohrabacher, and then I will finish.

Mr. HALL. Thank you, Mr. Chairman.

DEEPWATER DRILLING AND EPACT SECTION 999

Well, to Mr. Luján, I say he had a lot of good questions but they were really questions that ought to have been directed to the DOE, who could have answered them but they chose not to show up, and Mr. Carnahan, I like him with his idea of how something has to be paid for, because way back 10 or 15 years ago, I was on the Energy and Commerce Committee and we were looking for how to drill the depths of the Gulf, and with a lot of outside help. The major problem we had was how we were going to pay for it and what was there, and I sought a bill some ten years before it was passed. It was passed into I believe the 2005 bill is when that last good energy bill was passed that was supported by Democrats and Republicans, maybe mostly from the energy states, but it had support by both parties there. But they put my Ultra-Deep in as an amendment. I tried to put it in for ten years and finally we got it in that bill. I based it on the fact that we at that time knew the energy was there but we didn't have the technology to get it to the top, so Mr. Carnahan hits the ball right on the face of the bill when he says we need to have a way to pay for it. We detected a way to pay for it, to get people to do the technology parts and it became a technology bill more so than an energy bill with I think some 24 universities that were providing that technology. We paid them with energy we got up from there that we couldn't have gotten up without their technology, and with their technology we could, and I think that is operating now. It is known as the section 999 or the Ultra-Deep program.

Mr. Pappas, I think that you have some knowledge on that. I just want to ask you one quick question. I would like you to highlight some results of the R&D supported by the RPSEA and how it impacted our ability to conduct safe drilling, but I will just get right

to the point and ask you those. How can the section 999 program address technical challenges that improve deepwater drilling safety?

Mr. PAPPAS. The safety side of the business, yes, sir. Well, we have got several projects that are ongoing right now that really look promising. One of them is a composite riser for ultra deepwater, and what that would do is lighten the load. It makes it easier to move. It makes it safer and makes it more environmentally friendly. Another one would be a fatigue performance analysis. We don't have a correct way to look at analysis of risers and drilling equipment. It doesn't seem to work in deepwater right now. We use empirical equations. What we are trying to do is get down to the fundamental physics here, and so that helps out a whole lot.

I talked about the self-standing riser system. That has to do with interventions going back into wells that have been drilled and trying to help them out. There is no way of doing that economically right now, but what this does besides that is it gets you away from the heavy vessels, the heavy lifting that is necessary so it improves the safety of the people that are on board doing those kinds of things. A hybrid power system study that we are looking at would use other types of power such as wave energy and wind energy to try to supplement some of the power that we need for the production, not necessarily for drilling, but for production of wells. So if you can try to combine some of these things, perhaps they make sense so that we can go ahead and be more efficient in the way that we do business. So that is environmentally friendly in its own way.

Mr. HALL. Well, I might say that we had a lot of support, technical support from men of industry just like you that are coming and giving your time here today, one of whom is in the audience here that was of great benefit to me as we pushed for this. I rode with President Bush out to New Mexico to sign the energy bill. My amendment was in that bill for the first time in ten years. I felt good about it until, he, when he was signing it, recognized me standing behind him as there only to get some free coffee off of Air Force One. What he didn't know was I had six of his coffee mugs in my briefcase at that very time. But he signed that, and then later because he got knocked around a lot saying that he was supporting big energy firms, he turned and decided that he wanted to kill that bill and took a shot at us on the Floor through Congressman Markey, which he was turned back with the help of Republicans and Democrats, some 245 votes to 161, and there would be other assaults on that but it is the safe, paid-for thrust.

And the gentleman on the end suggested maybe a moratorium on drilling. Maybe he means a moratorium on the dangerous type of drilling, the most ultra deep, and he probably has a foot to stand on there but I can't understand anybody that wants just a whitewash all moratorium and knock out thousands and thousands of jobs right now to pursue a safety that they don't know whether it is safety or not, because like you say, we won't know until we get there and get that out. We won't know why their four checks didn't work but those are things that we will find out.

I yield back. I thank you for the time.

Chairman BAIRD. Thank you, Mr. Hall. I have actually spoken to former President Bush about his decision and he said that will teach Mr. Hall to steal my darn coffee cups.

Mr. HALL. He hasn't spoken to me since.

Chairman BAIRD. There is a take-home lesson here.

Mr. Rohrabacher, and then I will briefly ask a question and then we will finish up.

NEW TECHNOLOGY DEVELOPMENT AND DOE

Mr. ROHRABACHER. Well, thank you very much, Mr. Chairman, and again, I appreciate your leadership. Let us note that right here in this room we had a hearing a couple weeks ago, and Kevin Costner was here and he sat right over there where Mr. McCormack is sitting and told us that he had put considerable amount of investment of his own money into developing a technology that could have been put to use in doing what Dr. Baugh has described today of sucking up oil and water and separating it, but we are not now prepared to do that, but Kevin Costner a decade ago put his own money into that technology and it sat there, it sat unused and not put into a place where we could now mobilize it to help us solve this disaster or come to grips with it. So that, number one, was what came out of that hearing, and the Chairman and I want to note we met with Mr. Costner later and I think that again we must make sure we are doing our part here, and we are making sure that the Kevin Costners of the world or the people in the oil business were doing their part but we need to do our part here as well.

And one of the things we need is to make sure the executive branch, this isn't just legislative branch, it is very disappointing that the Department of Energy was not here today to participate. There are some serious questions that needed to be asked and they weren't here. But I think all of our witnesses presented some very fine ideas and insights and I thank them, and I thank you, Mr. Chairman.

Chairman BAIRD. Thank you, Mr. Rohrabacher. I share that concern. We hope to—we got a commitment from the Executive Branch to get a witness here, and we lament the absence, as well, but I appreciate that the Committee is focused on the witnesses who are here.

MORE ON INHERENT RISKS AND SAFETY IMPROVEMENT

I just want to thank my colleagues for their good questions and then our witnesses. This issue of risk—you know, Mr. McCormack, you talked about the cumulative effects of small risk. You know, NASA some years ago when they first started the moon mission, they set what appeared to be a microscopic probability of risk and it was something like one out of 100,000, a really low number, and people said, "why are you being so rigorous?" And they said, you know how many parts there are on a spaceship, and you add those up and even a little tiny valve fails and that prevents hydraulic fluid from going somewhere else, et cetera, et cetera. And so I am concerned about that, but then also, when we look at this, we too often in this institution say, well, how much money did you throw out, that shows whether you care or not, okay, and I don't think

we should do that. But conversely, if you throw relatively little money at something relative to everything else, it doesn't suggest a high priority. So when we look at RPSEA's expenditures and you say, you know, you listed some things and they all sounded impressive, they seem to have safety as an artifact almost. Maybe it will be a direct result. But how do we say going forward from here with RPSEA and API, look, we lost 11 lives, we are spending hundreds of billions of dollars over time—not hundreds of billions yet but we are spending many billions. Let us say that. How do we focus more on safety? And how do we know what we are doing is actually safety and whether it is human factors and training, whether it is better physical technology? Dr. Baugh mentioned improved shear technology. Then, as I listened to the shear things, it is like we have got the technology there. Unless there is something in the way, which there often is and then it doesn't work, so we need two of them, but there could also be something in the way of that second one and then it doesn't work. That is not reassuring. How do we say—I mean, if we know that, if we know our safety equipment can be blocked from working and yet we say to ourselves we are reassured. It is like I have a smoke detector in my house with no batteries in it, so educate me. How do we make sure RPSEA and API spend more attention so we are not here five years from now or ten years from now doing the same thing?

Mr. PAPPAS. Okay. Thank you very much. Mr. Chairman, as I mentioned earlier, we didn't realize we had a problem; the industry did not, anyway. So we have come together, and I detailed three different scenarios that we could look at going forward. You mentioned drilling down as a pun, but that is exactly what we have done, and we have come up with a list, and if I can read very quickly, okay?

Chairman BAIRD. Please do.

Mr. PAPPAS. Blowout preventer inspection and enforcement procedures including backup equipment and reporting requirements. Looking into all these things, by the way. Well controls procedures, training programs and/or response mechanisms for deepwater wells. Improved comprehensive safety management programs need to be looked at also. Emergency equipment certification, which was noted also, and testing improvements, streamlined reporting systems to governmental agencies, additional safety barriers during critical well construction stages such as what we had, well construction certification procedures for cement and tubular equipment, standardized well construction procedures from wellhead to reservoir, increased enforcement by government agencies including the training and the development of additional personnel. These are the ones that we identified right off the bat that need to be looked at as a group, and we have got folks in place to look at those.

Chairman BAIRD. I thank you, and I thank all the witnesses. Did you want to add to that, Mr. Milito? Please.

Mr. MILITO. Well, I was just going to point out that this is something industry is doing, but I think an important part of it is making sure that the regulators understand how the technology is advancing. And as part of our process, part of Mr. Pappas's process, MMS as a regulator should be involved in that. They should be in

our standards meetings so they can see how the industry is working together and what the technologies are so that the regs don't fall behind technology. In addition, they need to see what Mr. Pappas's group is doing so that the regulatory system is at that level, that we are not missing out on these opportunities.

Chairman BAIRD. And it would seem those regulators need to have, as Mr. McCormack pointed out, not only comparable levels of training, but also expertise in the specific type of environment that they are regulating rather than saying we are going to take something from dry land put it over on deepwater or shallow water onto deepwater, different exigencies of the environment.

Mr. MILITO. Agreed.

CLOSING

Chairman BAIRD. I want to thank the witnesses. The reason we are having these hearings and Mr. Gordon is working so hard and all of my colleagues are is that we don't want to see this happen again, and if we are going to try to respond to this, we think we need to improve our research portfolio, how it focuses on this, and maybe our regulatory portfolio. We want to do so in a way that is responsible and informed, not just something for symbolic, you know, we all feel good because we had a good, clever name to a bill. And your testimony today and your input will be incredibly helpful, and, as always on this Committee, the record will remain open for two weeks to give you all a chance to respond to any questions from members or if you have additional information you want to submit, and also for any additional statements from members.

With that, Mr. Hall has a final comment.

Mr. HALL. I just want to say we will miss Mr. Inglis in this Committee but we are also going to miss Dr. Ehlers and Dr. Baird, who have been good guidance for us and helpful in encouraging men and women like you to come and testify and give us your time, and we are going to miss you, Doctor, very much. I will miss some of the trips that we didn't get to make that we always planned, but you have been a gentleman and I have agreed with you not 100 percent of the time but when I didn't agree with you, you were probably wrong.

Chairman BAIRD. I will accept that.

Mr. HALL. Or maybe I was the one that was wrong. Anyway, we thank you for your long service here and look forward to working with you even after you are gone. Come on back. My door will always be open to you.

Chairman BAIRD. I am honored by that. Thank you.

The witnesses did an outstanding job both in preparation and your presentation today. We are grateful for your service. Again, if there is any information we didn't cover in the limited time, feel free to let us know. Thank you.

With that, the Committee stands adjourned. Thanks to all my colleagues for their good questions and input.

[Whereupon, at 12:00 p.m., the Subcommittee was adjourned.]

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