

Exhibit 10

Defendants' Exhibit 10
Hornbeck v. Salazar, 10-cv-1663

DEPARTMENT OF THE INTERIOR

INCREASED SAFETY MEASURES FOR ENERGY DEVELOPMENT ON THE OUTER CONTINENTAL SHELF

MAY 27, 2010

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I. INTRODUCTION

On April 20, 2010, the crew of the Transocean drilling rig *Deepwater Horizon* was preparing to temporarily abandon BP's discovery well at the Macondo prospect 52 miles from shore in 4,992 feet of water in the Gulf of Mexico. An explosion and subsequent fire on the rig caused 11 fatalities and several injuries. The rig sank two days later, resulting in an uncontrolled release of oil that has been declared a spill of national significance. The Nation faces a potentially massive and unprecedented environmental disaster, which has already resulted in the tragic loss of life and personal injuries as well as significant harm to wildlife, coastal ecosystems, and other natural resources. The disaster is commanding the Department of the Interior's resources as we work to ensure that the spill is stopped and the well permanently plugged; that our natural resources along the Gulf Coast are protected and restored; and that we get to the bottom of what happened and hold those responsible accountable.

On April 30, 2010, the President ordered the Secretary of the Interior to evaluate what, if any, additional precautions and technologies should be required to improve the safety of oil and gas exploration and production operations on the Outer Continental Shelf (OCS). In addition to this review of the OCS regulatory structure, the President recently created the bipartisan National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling. The President established the National Commission to examine the relevant facts and circumstances concerning the root causes of the BP Oil Spill, to develop options for guarding against, and mitigating the impact of, oil spills associated with offshore drilling, and to submit a final public report to him with its findings and options for consideration within six months of the date of the Commission's first meeting.

In addition, the Departments of the Interior and Homeland Security are undertaking a joint investigation into the causes of the BP Oil Spill, including holding public hearings, calling witnesses, and taking any other steps necessary to determine the cause of the spill. Several committees in Congress have held and will continue to hold hearings on the events associated with the BP Oil Spill. Respecting the ongoing investigations, this report does not speculate as to the possible causes of the BP Oil Spill. This report is intended to identify an initial set of safety measures that can and will be implemented as soon as practicable to improve the safety of offshore oil and gas development.

To provide context for the safety recommendations, this report presents a history of OCS production, spills, and blowouts, a review of the existing U.S. regulatory and enforcement structure, a survey of other countries' regulatory approaches, and a summary of existing Minerals Management Service (MMS)-sponsored studies on technologies that could reduce the risk of blowouts.

In compiling the recommendations presented in this report, the Department has drawn from expertise within the Federal Government, academia, professional engineers, industry, and other governments' regulatory programs. In particular, seven members of the National Academy of Engineering peer reviewed the recommendations in this report. The Department received ideas from the Department of Energy National Laboratories on ways to improve offshore safety. Appendix 1 lists expert consultations for this report.

This report examines all aspects of drilling operations, including equipment, procedures, personnel management, and inspections and verification in an effort to identify safety and environmental protection measures that would reduce the risk of a catastrophic event. (A brief primer on offshore drilling technology and systems is included in Appendix 2). In particular, this report examines several issues highlighted by the BP Oil Spill regarding operational and personnel safety while conducting drilling operations in deepwater environments.

While technological progress has enabled the pursuit of deeper oil and gas deposits in deeper water, the risks associated with operating in water depths in excess of 1,000 feet are significantly more complex than in shallow water. This report describes safety and environmental issues involved in offshore drilling, including the unique challenges associated with drilling operations in deepwater.

The recommendations address well-control and well abandonment operations; specific requirements for devices, such as blowout preventers (BOPs) and their testing; industry practices; worker training; inspection protocol and operator oversight; and the responsibility of the Department for safety and enforcement.

In developing the recommendations contained in this report, the Department has been guided by the principle that feasible measures that materially and undeniably reduce the risk of a loss-of-well-control event should be pursued. Therefore, some recommended measures—particularly those the Department intends to implement immediately—are necessarily prescriptive. At the same time, the Department is examining innovative ways to promote a culture of safety for offshore operations by addressing the human element of operations. The Department is committed to moving to finalize a rulemaking that would require operators to adopt a systems-based approach to safety and environmental management. This rule would require operators to incorporate global best practices regarding environmental and safety management on offshore platforms into their operating plans and procedures. In finalizing this rulemaking, the Department will analyze carefully the current circumstances in the Gulf of Mexico and lessons learned from the ongoing investigation into the causes of the BP Oil Spill.

To realize an improved margin of safety associated with the recommended equipment standards and operating procedures, the report proposes new inspection and verification measures, which the Department will implement. Several of these efforts will also allow the public to access information about the inspection and verification structures, to promote confidence that: (1) the Federal Government undertakes appropriate actions to review, audit, and confirm industry performance; and (2) industry follows the best possible practices and the new set of regulatory requirements.

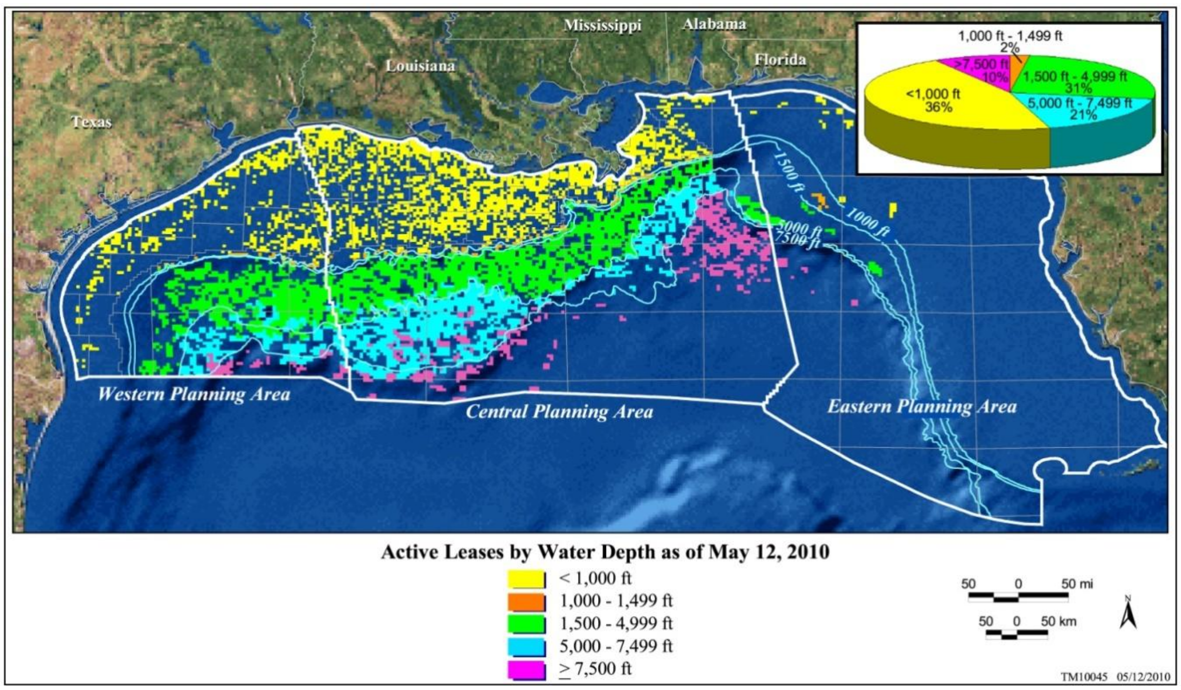
A comprehensive set of reforms encompassing all aspects of oil and gas development on the OCS simply could not be fully developed in the 30-day timeframe of this report. With respect to some safety measures, the Department will undertake further study―with appropriate input from independent experts, academia, industry, and other stakeholders―to develop new regulations and other appropriate steps to promote drilling safety. These Department-led strike teams will also help to inform the work of the President's new bipartisan National Commission. Finally, this report does not address several important issues associated with the safety of offshore drilling that implicate shared responsibilities with other departments and agencies. For example, the Department will work in close cooperation with the Department of Homeland Security, including the United States Coast Guard, the Environmental Protection Agency, and other agencies to evaluate and improve oil spill response capabilities and industry responsibilities.

II. OFFSHORE OIL AND GAS PRODUCTION

A. Federal OCS Oil and Gas Activities

The Gulf of Mexico provides 97 percent of Federal OCS production. The Gulf of Mexico has nearly 7,000 active leases (see Figure 1), 64 percent of which are in deepwater. The Pacific OCS has 49 active leases off the coast of Southern California, 43 of which are producing. There have been no Pacific OCS lease sales since 1984. Alaska has 675 active leases and production from a single joint State-Federal field. The Atlantic does not have any active leases or production.

Figure 1
Gulf of Mexico OCS Active Leases



Source: Minerals Management Service Database, 2010.

Since 1947, more than 50,000 wells have been drilled in the Federal Gulf of Mexico, and there are now approximately 3,600 structures in the Gulf. In 2009, production from these structures accounted for 31 percent of total domestic oil production and 11 percent of total domestic, marketed natural gas production. Oil production in 2009 represented the second highest annual production for the Gulf of Mexico OCS (see Figure 2). Minerals Management Service Database, 2010.

Since the first major deepwater leasing boom in 1995 and 1996, a sustained and robust expansion of deepwater drilling activity has occurred, largely enabled by major advances in drilling

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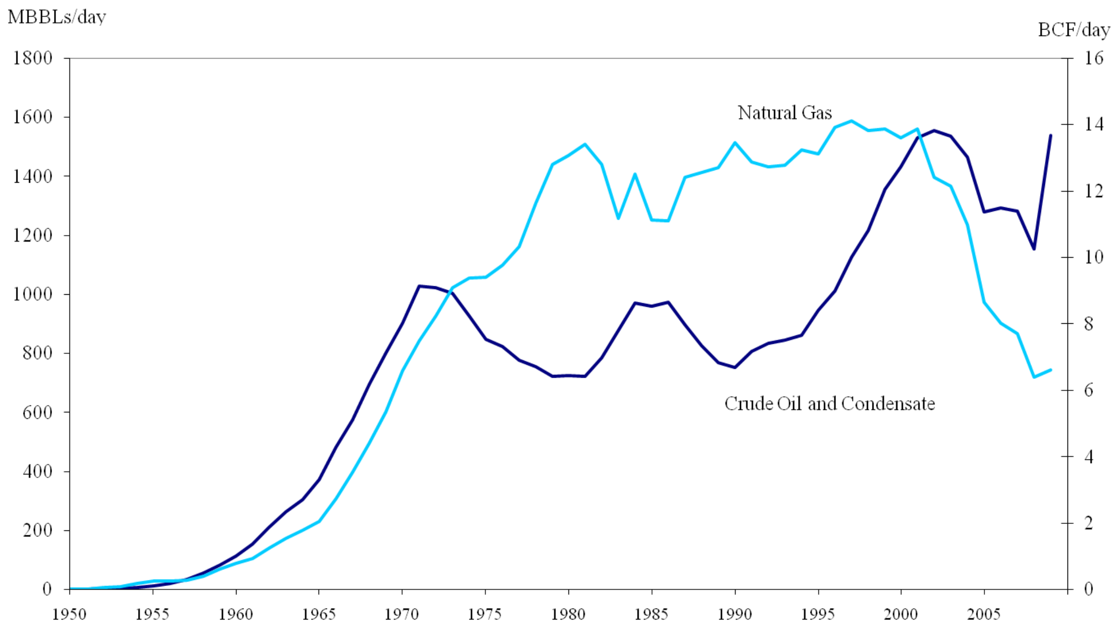
technology. In 2001, U.S. deepwater offshore oil production surpassed shallow water offshore oil production for the first time. By 2009, 80 percent of offshore oil production and 45 percent of natural gas production occurred in water depths in excess of 1,000 feet, and industry had drilled nearly 4,000 wells to those depths. In 2007, a record 15 rigs were drilling for oil and gas in water depths of 5,000 feet or more in the Gulf of Mexico. Operators have drilled about 700 wells in water depths of 5,000 feet or greater in the OCS. While fewer wells are drilled in the OCS today, they tend to be more sophisticated with higher per-well production levels than those in the past.

Figure 2
Gulf of Mexico OCS Oil and Gas Production



Source: Minerals Management Service Database, 2010.

Since 1953, the Federal Government has received approximately $200 billion in lease bonuses, fees, and royalty payments from OCS oil and gas operators. Last year, the Federal OCS leasing revenue was $6 billion. The OCS oil and gas industry provides relatively high-paying jobs in drilling and production activities, as well as employment in supporting industries. Offshore operations provide direct employment estimated at 150,000 jobs. Minerals Management Service Database, 2010.

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B. OCS Petroleum Spills

Since the 1969 Santa Barbara, California, oil spill, there have been relatively few major oil spills from offshore oil and gas operations in the U.S. and around the world. Yet several notable blowouts have occurred, including one in June 1979, when the Ixtoc I exploratory well located about 50 miles off the Yucatan Peninsula blew out and was not brought under control until March 1980, releasing over three million barrels of oil off the coast of the Mexican state of Campeche. In 2009, the Australian Montara well in the Timor Sea blew out and was not brought under control for more than 10 weeks, releasing oil into the open ocean and forming a thin sheen covering up to 10,000 square miles. Nevertheless, the relatively infrequent occurrence of a major oil spill from an offshore drilling operation has led many to view these operations as safe.

From 1964 to 2009, operators in the Federal OCS produced about 17.5 billion barrels of oil (crude oil and condensate). Over this same time, the total estimated petroleum volume spilled from OCS activities was approximately 532,000 barrels, or 30.3 barrels spilled per million barrels produced. The spill rates from OCS platform and rig activities improved each decade from the 1960s through the 1990s, although the past decade reversed this trend (see Table 1). The oil spilled from OCS rigs and platforms over the past 30 years totaled about 27,000 barrels, illustrating how a catastrophic spill like the current BP Oil Spill can vastly exceed the impacts of typical spills on the OCS.

Table 1
Crude Oil Spills from Platform and Rigs from Federal OCS Activities, 1960-2009

Time Period	OCS Oil Production (Thousand Barrels)	Number of Spills	Barrels Spilled (Thousand Barrels)	Thousand Barrels Produced per Barrel Spilled
1960-1969	1,460,000	13	99	15
1970-1979	3,455,000	32	106	33
1980-1989	3,387,000	38	7	473
1990-1999	4,051,000	15	2	1,592
2000-2009	5,450,000	72	18	296

Note: Only covers spills of 50 barrels or more.

Source: Minerals Management Service Database, 2010.

Blowouts represent a type of loss of well control event that can result in large discharges of oil into the natural environment. Since 1970, the number of blowouts per number of wells drilled has varied significantly from year to year. From 1964 through 1970, a total of approximately 178,000 barrels of oil was spilled on the Federal OCS as a result of blowout events (see Table 2). Of this total, about 13,000 barrels resulted from blowouts related to external forces, such as hurricanes and ship collisions. An additional 30,000 barrels were released when a production fire resulted in the loss of well control of 12 wells on a production platform. The remaining

135,000 barrels that were released during blowouts occurred during drilling, well completion, or workover operations.

Table 2
Blowout Events Exceeding 1,000 Barrels on the Federal Outer Continental Shelf, 1964-2009

Year	Description of Event
1964	Two blowouts associated with a hurricane event that destroyed four platforms. Total of 10,280 barrels crude oil spilled.
1965	One blowout associated with drilling. 1,688 barrels condensate spilled.
1969	One blowout that occurred when a supply vessel collided with a drilling rig during a storm and sheared the wellhead. 2,500 barrels crude oil spilled.
1969	One blowout (Santa Barbara, California) was associated with drilling. 80,000 barrels spilled.
1970	One blowout was caused by a fire in the production area that resulted in the loss of control of 12 wells on the platform. 30,000 barrels crude oil spilled.
1970	One blowout associated with wireline work during workover operations. 53,000 barrels spilled.

Source: Minerals Management Service Database, 2010.

After these blowouts, in the period from 1971 through 2009, a total of approximately 1,800 barrels was spilled on the Federal OCS as a result of blowout events. Of that amount, 425 barrels were blowouts resulting from hurricane damage. An additional 450 barrels occurred at an oil pump during production operations. Since 1956, 15 blowouts resulted in at least one fatality; three of these events occurred after 1986.

While the rate of blowouts per well drilled has not increased, even as more activity has moved into deeper water, the experience with the BP Oil Spill illustrates the significant challenges in containing a blowout in deepwater, as compared to containing a blowout in shallower water.

III. EXISTING WELL CONTROL STUDIES

The Department has conducted research related to offshore oil and gas exploration, development, and production for two purposes: (1) to augment the overall knowledge base in the field, and (2) to identify information supporting new or modified requirements in a regulation or recommended practices. The Department maintains interagency agreements and working arrangements for research with other Federal agencies who share responsibility for regulatory oversight of OCS operations, including the Departments of Commerce, Energy, and Transportation.

Through the Technical Assessment & Research (TA&R) Program, the Department studies the operational safety, technology, and the pollution prevention and spill response capabilities associated with offshore operations. The TA&R Program serves "to promote new technology and safety through the funding of collective research with industry, academia, and other government agencies and disseminate findings through a variety of public forums." *Minerals Management Service Engineering and Research Branch 2008-2012 Strategic Plan*. This program has funded or co-funded numerous studies investigating the use of well control techniques and equipment, including those associated with drilling fluid of a specified weight and circulation, cement with a specific bond and integrity, casing with a specific design, pressure control safety valves, and BOPs (see Table 3 for a list of well control studies funded by the Department since 1990). These studies have led to offshore drilling safety improvements around the world.

Table 3
TA&R Funded Well Control Research, 1990-2010

Study No.	Title of Study	Completion Date
8	Blowout Prevention Procedures for Deepwater Drilling	1978 to 2003
150	Floating Vessel Blowout Control	December 1991
151	Investigation of Simulated Oil Well Blowout Fires	1989 to 1993
170	Improved Means of Offshore Platform Fire Resistance	1991 and 1994
220	Study of Human Factors in Offshore Operations	1995 to 1997
253	Blowout Preventer Study	December 1996
264	Development of Improved Drill String Safety Valve Design and Specifications	1996 and 1998
319	Reliability of Subsea Blowout Preventer Systems for Deepwater Applications–Phase II	November 1999
382	Experimental Validation of Well Control Procedures in Deepwater	December 2005
383	Performance of Deepwater BOP Equipment During Well Control Events	July 2001
403	Repeatability and Effectiveness of Subsurface-Controlled Safety Valves	March 2003
408	Development of a Blowout Intervention Method and Dynamic Kill Simulated for Blowouts in Ultra-Deepwater	December 2004
431	Evaluation of Secondary Intervention Methods in Well Control	March 2003
440	Development and Assessment of Well Control Procedures for Extended Reach and Multilateral Wells	December 2004
455	Review of Shear Ram Capabilities	December 2004

463	Evaluation of Sheer Ram Capabilities	September 2004
519	Drilling and Completion Gaps for High Temperature and High Pressure In Deep Water	June 2006
540	Risk Assessment of Surface vs. Subsurface BOP's on Mobile Offshore Drilling Units	August 2006
541	Application of Dual Gradient Technology to Top Hole Drilling	November 2006
566	Using Equipment, Particularly BOP and Wellhead Components in Excess of the Rated Working Pressure	October 2006
582	A Probabilistic Approach to Risk Assessment of Managed Pressure Drilling in Offshore Drilling Applications	October 2008
631	Risk Profile of Dual Gradient Drilling	Estimated completion in September 2010
640	Risk Analysis of Using a Surface Blow Out Preventer	April 2010

Note: This report includes hyperlinks to the reports via the study numbers.

Source: Minerals Management Service Database, 2010.

These studies have examined, among other things, blind shear ram capabilities, back-up BOP systems, and drilling and cementing design and operations, which have informed the setting of Department regulations. For example, the 1999 *Reliability of Subsea BOP systems for Deepwater Applications* (study number 319) recommended modifying testing regulations to ensure that the testing of variable pipe rams appropriately account for the diameters of all the sizes of pipe in use in a given drilling project. The Department used this recommendation in revising its 2003 final drilling regulations.

The 2002 *Review of Shear Ram Capabilities* (study number 455) identified issues associated with the cutting power of shear rams, which are intended to cut through drill pipe when the well must be secured in an emergency situation. The Department adopted the report's recommendation that the BOP must be capable of shearing pipe planned for use in current drilling programs under 30 CFR 250.416(e). This regulation requires the submittal of information demonstrating that shear rams on the proposed BOP stack can cut drill pipe under maximum anticipated surface pressure.

The 2004 *Evaluation of Sheer Ram Capabilities* (study number 463) expanded on the analysis in study number 455 through an evaluation of BOP shear rams under the most demanding conditions. In this study, 214 pipe samples were tested against various ram models, and 16 (7.5 percent) were unsuccessful in shearing the pipe below a certain pressure (3,000 pounds per square inch). All 16 of these cases involved a particular combination of shear ram and pipe, which was found unsuitable for actual drilling operations. The results of this study confirmed the regulatory decision to require operators to submit documentation that shows the shear rams are capable of shearing the pipe in the hole under maximum anticipated surface pressures.

The 2003 *Evaluation of Secondary Intervention Methods in Well Control* (study number 431) reviewed the design and capabilities of various secondary BOP intervention systems used in practice. Secondary intervention represents an alternate means to operate BOP functions in the event of total loss of the primary control system or a means to assist personnel during situations involving imminent equipment failure or well-control problems. This study discusses the possible use of acoustic systems in the Gulf of Mexico. According to the report, there remain significant doubts about the ability of an acoustic control system to provide a reliable emergency back-up to the primary control system during an actual well flow event.

IV. LEGAL FRAMEWORK, INSPECTIONS, AND ENFORCEMENT

A. Statutory Authority

In 1953, the Congress passed the Outer Continental Shelf Lands Act (OCSLA) that defines the OCS as any submerged land outside state jurisdiction and established Federal jurisdiction over these waters and all resources they contain. The OCSLA also set Federal responsibilities for managing and maintaining the OCS subject to environmental constraints and safety concerns. The legislation authorized the Department to lease areas of the OCS for development and to regulate offshore operations and development. Since then, the OCSLA has been amended to address changing issues, including the 1978 requirement for the Department to develop 5-year leasing program schedules after consideration of environmental, social, and economic effects of natural gas and oil activity on OCS resources, location-specific risks, energy needs, laws, and stakeholder interests. This amendment also requires the Department to seek a balance between potential damage to the environment and coastal areas and potential energy supply. The first 5-year leasing program started in 1980 and the current 5-year plan ends in 2012.

Congress has also enacted laws to promote production in frontier areas like the Gulf of Mexico deepwater. For example, the 1995 Deepwater Royalty Relief Act encouraged oil and gas development in the Gulf of Mexico in water depths greater than 200 meters (656 feet) through royalty relief. Royalty relief incentives were also offered to encourage production from wells drilled for deep natural gas (greater than 15,000 feet or 4,572 meters total depth) on new leases located in shallow waters (less than 200 meters). The Energy Policy Act of 2005 included additional incentives for oil and gas development in offshore areas to stimulate production in deepwater and expanded the OSCLA to include the areas offshore Alaska for royalty suspension.

Oil and gas leasing and operations are subject to environmental reviews under the National Environmental Policy Act (NEPA). On May 14, 2010, Secretary of the Interior Ken Salazar and the Council on Environmental Quality Chair Nancy Sutley announced a full review of NEPA compliance for oil and gas activities on the OCS, and accordingly, NEPA will not be covered in this report.

B. Regulations

Under the OCSLA, the Secretary of the Interior, through the MMS, manages and regulates leasing, exploration, development, and production of resources on the OCS. Current regulations are a combination of prescriptive and performance-based measures.

Prescriptive regulations specify rules or courses of action that must be explicitly followed in order to comply with regulation. A prescriptive approach sets clear rules for industry to follow. Performance-based regulations, in contrast, specify objectives for industry to achieve but allow flexibility in the technology and approaches used to meet these objectives. This approach allows improved technologies and methodologies to be incorporated into industry practices without major revisions to regulations and puts the onus on industry to develop systems for continuous improvement of safety and environmental protection practices. Internationally, many countries (e.g., United Kingdom, Norway, and Australia) are moving toward more performance-based regulations. The Department also incorporates by reference recommended practices and standards from industry associations and technical standard setting groups such as the American National Standards Institute, API standards and recommended practice documents, and National Association of Corrosion Engineers documents. The Department also issues Notice to Lessees (NTLs) to clarify and provide direction on regulatory requirements.

The regulations in 30 CFR 250 govern important drilling operations on the OCS. Subpart D covers all aspects of the drilling operation including permitting, casing requirements, cementing requirements, diverter systems, BOP systems, drilling fluids requirements, equipment testing, and reporting. The minimum requirements for BOPs are stated in detail, including system components, surface and subsea BOP stacks, associated systems and equipment, choke manifolds, kelly valves, drill-string safety valves, maintenance and inspections, pressure tests and additional testing, and recordkeeping. Subpart Q covers decommissioning, which includes temporary abandonment of wells. These regulations are mainly prescriptive in nature, and convey the minimum requirements for safe operations.

While regulations governing OCS exploration, development, and production activities have been largely prescriptive, the Department has been considering more performance-based approaches. For example, the 2002 Subpart O (30 CFR 250.1500) training rule is a performance-based regulation. In addition, the Department has incorporated by reference nearly 100 consensus standards into current offshore operating regulations. In this way, the Department imposes a responsibility on operators to ensure safe operations through compliance with prescribed standards as well as compliance with performance-based, overarching measures. As such, it is the responsibility of operators to meet the requirements of 30 CFR 250.401:

> **What must I do to keep wells under control?** You must take necessary precautions to keep wells under control at all times. You must: (a) Use the best available and safest drilling technology to monitor and evaluate well conditions and to minimize the potential for the well to flow or kick and…(e) Use and maintain equipment and materials necessary to ensure the safety and protection of personnel, equipment, natural resources, and the environment.

Review of Applications for Permit to Drill (APDs)

Upon receipt of an APD, the Department reviews the approval documents for the Exploration or Development Plans for conditions that apply to the APD or the well's proposed location. The Department also assesses whether the applicant has oil spill financial responsibility coverage.

The Department conducts an engineering review of the APD, to check the proposed drilling rig's maximum operating limits for drilling depth and water depth to ensure appropriateness for the proposed well program. The review consists of, but is not limited to, the proposed procedure, well location and directional program, geological and geophysical hazards, subsurface environment for pore pressure and fracture gradient, wellbore design and schematic, design calculations for pressure containment during drilling and completion, cement volumes, and testing pressures for the well control equipment, casing and casing shoe. This review is performed for shallow and deepwater drilling operations, and a hurricane risk assessment is performed during hurricane season. The Department reviews APDs to determine how the proposed operation satisfies the regulations in meeting its objective of safely reaching a targeted depth. This review includes an assessment of:

- well casing setting depths determined by formation strength, predicted formation fluid pressure, drilling mud weight limits, any anticipated subsurface hazards;
- effectiveness of well casing strength for pressure containment at its specified depth;
- effectiveness of cementing the well casing after successfully securing and isolating the hydrocarbon zones or any encountered subsurface hazards; and
- maintaining well control by adjusting drilling mud properties and the use of well control equipment such as diverters and BOPs.

The Department reviews the operator's plans and APDs to verify the use of best available and safest technology (BAST), and inspections verify the use of approved equipment and maintenance thereof.

Upon completing the engineering review, the Department may approve the APD with conditions if warranted, return it to the operator for modifications, or deny it. If the applicant makes changes to the drilling application, the Department must grant approval before the applicant performs its work.

C. Inspections

The Department maintains a comprehensive inspection program to promote the safety of offshore oil and gas operations on the OCS. This program places inspectors offshore on drilling rigs and production platforms to enforce operator compliance with Federal safety and environmental protection requirements. When a drilling rig enters Federal waters to drill a well, Federal inspectors will meet the rig where it is moored to provide training to the rig operators about the Federal regulatory structure. At this time, inspectors will conduct a drilling inspection of the equipment. It is Departmental policy for inspectors to inspect the rig once on location every 30 days.

For production platforms, it is practice for initial inspections to take place during the fabrication of the platform at a shipyard. Federal inspectors and engineers review the flow diagrams and charts to determine if the specific facility meets regulatory requirements. A complete production inspection of the facility occurs typically about 30 to 45 days after a production platform is installed.

After operations begin, the Department conducts additional announced and unannounced inspections. Inspectors typically give the operator a few days notice for announced inspections. Inspectors also fly to platforms or rigs unannounced, and in such cases, inspectors contact the operator as they approach the facility. These unannounced inspections foster a climate of safe operations, maintain an inspector presence, and allow regulators to focus on operators with a poor performance record. They are also conducted after a critical safety feature has previously been found defective during previous inspections or by operator reporting.

During a drilling inspection an inspector typically conducts the following:

- a general safety walk through of the facility looking for general housekeeping hazards related to slips/trips/falls/railings/open gratings;

- verification of the location of gas detectors/hydrogen sulfide detectors/mud volume detectors;

- verification that the mud trip tank is operational and properly marked (graduated), that appropriate quantities of a mud weighting material are onboard (barite), and that the drilling mud currently in use has been periodically tested and is of the proper density as indicated in the APD (viewing mud logger's report);

- verification that proper well control data relative to the well depth and type of tubulars (drill pipe, casing) in the well is clearly marked and posted on the rig floor and that there are remote BOP and Diverter control panels on the facility;

- verification that equipment is properly grounded and that drill string safety valves with proper wrenches for the diameter of drill pipe or casing currently in the well are located on the drill floor in an open position and within easy access to rig personnel;

- verification that the crown block safety device is installed and operational and that fresh air intakes are properly located on the rig;

- verification that diesel engines have required shut down devices, that breathing air is properly labeled, that engine exhaust is insulated;

- verification that crane load charts on platform rigs have been recorded, that all equipment has proper catch basins/drains/curbs/gutters/drip pans, that the facility is properly marked as to location, that the facility is properly lighted;

- if drilling is being conducted on a production facility, verification that there is an operational Emergency Shut Down device on the rig floor;

- verification of the status/switch position of the BOP pumps that the stand-by pump operates in an automatic fashion, that the accumulator bottles are in service;

- review the BOP tests records;

- checks the Subpart O well control status of contractor and lessee employees;

- checks for certain Potential Incidents of Noncompliance, which allow the inspector to check for general competency related to drilling operations; and

- inspectors may test, randomly or as a result of a safety concern, an offshore employee's competency with various safety devices.

The records check and documentation components of a drilling inspection apply to equipment, procedures, and operations that were conducted prior to the inspector boarding the facility, including but not limited to casing, cement, diverter, and BOP pressure testing results, casing setting depths, cement volumes, proper wait on cement time, formation pressure integrity tests, formation evaluation tests, required well control drills, hydrogen sulfide training certifications, and gas detector and hydrogen sulfide detector calibration records. Furthermore, the inspector confirms that proper paperwork is available in regard to any granted departures approved during the drilling of the well which were not previously approved in the APD.

During 2009, industry drilled a total of 331 wells in the Gulf of Mexico, and the MMS Gulf of Mexico Region conducted the following types and numbers of inspections:

- 561 drilling inspections;

- 3,678 production inspections;

- 268 well workover and well completion inspections;

- 6,804 meter inspections;

- 82 abandonment inspections;

- 4,837 pipelines inspections; and

- 3,342 personal safety inspections, on behalf of the U.S. Coast Guard.

E. Enforcement

The Secretary of the Interior, the Secretary of the Army, and the U.S. Coast Guard have the authority to pursue civil and criminal enforcement actions against persons who violate the OCSLA, the regulations created to implement the OCSLA, and the terms of any lease, license, or permit issued under OCSLA. The Department maintains a National Potential Incident of Noncompliance (PINC) List to help inspectors carry out enforcement actions: it contains a checklist of requirements for specific installations or procedures and prescribed enforcement actions consisting of written warnings, shut-in of a component, including wells, equipment, or pipelines, or shut-in of an entire platform if noncompliance with the National PINC is detected. If the violation does not impose an immediate danger to personnel or equipment, a warning Incident of Noncompliance (INC) is issued. An INC must be corrected within 14 days from the time specified on the INC, and the operator may not continue the activity in question until it has corrected the INC.

The OCSLA (43 U.S.C. § 1334(a)(2)) and regulations at 30 CFR 250.181-188 authorize the Secretary to cancel a lease or permit if, after opportunity and notice for a hearing, it is determined that: (1) continued activity would probably cause serious harm or damage to life, property, the environment, minerals, or national security or defense; (2) the threat of harm or damage will not disappear or decrease to an acceptable extent within a reasonable time; (3) the advantages of cancellation outweigh the advantages of continued activity; and (4) a suspension has been in effect for at least five years or the termination of suspension and lease cancellation are at the request of the lessee.

Regulations appearing in 30 CFR 250.135-136 provide for a disqualification process for operators exhibiting chronic poor compliance. This procedure allows operators to be placed on probation and requires that they submit Performance Improvement Plans. This gives the operator an opportunity to improve their performance. Should it not improve during a specified time, the operator may be disqualified from operating a given facility, including up to any and all facilities. Ultimately, an operator can go through Departmental debarment procedures that would prevent it from transacting any business with the Federal Government.

Under 43 U.S.C. § 1350(b) of the OCSLA, as amended, and regulations appearing at 30 CFR 250.200-206, civil penalties can be assessed for failure to comply with responsibilities under the law, a lease, a license, a permit, or any regulation or order issued pursuant to the Act. In addition to the enforcement actions specified above, civil penalty of up to $35,000 per violation per day may be assessed if: (1) the operator fails to correct the violation in the amount of time specified on the INC; or (2) the violation resulted in a threat of serious, irreparable, or immediate harm or damage to life, property, minerals, or the environment. On a drilling rig, for example, 160 items are checked for potential violations. If significant enough, the violation may call for the particular well component or the entire complex to be shut in. In 2009, drilling operations of 20 facilities were shut-in.

V. REGULATORY AUTHORITY AND REQUIREMENTS IN OTHER NATIONS

There have been and continue to be a number of approaches for regulating offshore drilling activity. Some countries have adopted a prescriptive approach directing offshore oil and gas activities through detailed regulations and requirements, while other regulatory bodies have adopted a performance-based approach. Some regulators have adopted a hybrid approach by being prescriptive in areas deemed critical, while also establishing broad performance parameters where they deem industry needs the latitude to meet particular objectives.

There is a major difference among offshore oil and gas regulators in the number of technical standards referenced within their regulations, and the effect of referenced standards. For example, in the United Kingdom, the standards are not compulsory, while in the United States, referenced standards have the same status as regulations. A standard is a formal document that establishes or defines a method or practice; these may also be called recommended practices. Some of the standards developing organizations, referenced in the regulations, include API, American Society of Mechanical Engineers, and American National Standards Institute. The following summarizes the regulatory structures in Norway, the United Kingdom, Australia, and Canada.

Norway

Over the past 40 years, Norway has moved from a prescriptive to a performance-based approach for regulating offshore oil and gas. Like the United States today with joint regulatory oversight of mobile drilling rigs by the Department and the U.S. Coast Guard, Norway originally regulated mobile units through its maritime authority and fixed installations by the Norwegian Petroleum Directorate (NPD).

Over time, the NPD has developed new approaches, including "compliance responsibility" that required companies to verify that their business was run acceptably and in line with the rules. The NPD eliminated the concept of inspection and replaced it with the concept of "supervision." They also replaced the term "approvals" with "consents." Supervision spans audits, verification, investigations, and most significantly, interaction with industry in the form of studies, professional seminars, and the development of regulations. These changes transformed the earlier approvals system that had the effect of the NPD being a virtual guarantor that company activities were acceptable into one centered on the concept of consent.

Since this major change in 1985, the trend has been away from prescription towards a regulatory approach based more on performance and risk management. Also, a series of reforms has resulted in regulations that are aligned with the changes in regulatory approach. Norway's regulatory requirements are general and primarily specify the conditions or functions that must be achieved to be compliant. Within this framework, companies have the freedom to choose practical solutions along with the responsibility to ensure compliance. To avoid misunderstandings about requirements for complying with the regulations, non-binding recommendations and guidelines have also been issued that reference reputable Norwegian and/or international industrial standards for structures, equipment, or procedures. These recommendations and guidelines rely primarily on Det Norske Veritas *Offshore Standards* that provide technical requirements and acceptance criteria and *Recommended Practices* for proven technology and sound engineering practice.

This approach also means that the regulator must keep abreast of and participate in developing and revising industry standards to ensure that they remain relevant and reflect best practice. Supervision by the regulator involves checking whether the administrative management systems at the companies ensure acceptable operation. This auditing must be conducted by personnel who have special technical and management expertise and experience.

The NPD acknowledges that the requirements for successfully delivering performance-based regulations demands extensive participation from industry, employees, and the regulator in terms of expertise, management and flexibility. To achieve a safe and environmentally responsible offshore work environment, strategic, and operational plans must be drawn up, selected development measures implemented, progress monitored and corrective action taken when problems arise.

The Petroleum Safety Authority Norway (PSA) was established as an independent government regulator in 2004. It took over the safety department of the NPD and continued its role. Its authority was also extended to cover supervision of safety, emergency preparedness, and the working environment for petroleum-related plants and associated pipeline systems on land. Norway is working toward harmonizing their regulations for offshore and land-based petroleum operations under the PSA.

United Kingdom

The UK safety regulation is predominantly performance-based. Indeed, the safety case concept for offshore oil and gas operation began after the 1988 explosion and resulting fire of a North Sea oil production platform called Piper Alpha, which killed 167 men. The subsequent investigation led to the issuance of the Public Inquiry into the Piper Alpha Disaster (the Lord Cullen report) and the reorganization of the UK offshore safety laws from prescriptive to a safety case approach. UK standards describe objectives, and operators can select the methods and equipment used to achieve these objectives and meet their statutory obligations. Complementing the safety case regulations are approved codes of practice and guidance documents.

The UK regulates offshore oil and gas through the Health and Safety Executive (HSE). The core activities of HSE are safety case assessment, verification, inspection, investigation, and enforcement. The approval process for the HSE is case-specific, and each case must be accepted and approved before offshore installation operates. A government inspectorate is in place as an assurance mechanism. The HSE oversight includes over 300 installations including, production platforms, Floating Production Storage and Offloading units, and mobile offshore drilling units. Other legislation is applied offshore on an activity basis. In 1992, the Offshore Installation (Safety Case) Regulations were introduced into the UK sector. These require all fixed and mobile offshore installations operating in UK waters to have a safety case which must be reviewed and approved by the Health and Safety Executive.

Australia

The organization responsible for regulating Australia's oil and gas industry is The National Offshore Petroleum Safety Authority, an independent statutory agency designated under the Commonwealth *Offshore Petroleum and Greenhouse Gas Storage Act 2006*. This organization implements a performance-based regulatory approach. The regulator is responsible for providing assurance that the operators address risks identified by a safety case. The organization includes a joint government inspectorate, and requires third party validations for regulatory assurance. Each manned facility is inspected at least once every year. The inspections are planned and usually take several days. The subject of planned inspections includes both control and management of major equipment and occupational health and safety.

The primary features of the Australian regulatory system are:

- Duties of care: Specific categories of persons (operators, employers, etc.) who are involved in offshore petroleum activities at facilities are required to "take all reasonably practicable steps" to protect the health and safety of the facility workforce and of any other persons who may be affected.

- Consultation provisions: Mechanisms are set out that will enable effective consultation between each facility operator, relevant employers, and the workforce regarding occupational health and safety.

- Powers of inspectors: Inspectors are granted powers to enter offshore facilities or other relevant premises, conduct inspections, interview people, seize evidence and otherwise take action to ensure compliance by parties with legal obligations.

- Standards and best practices are based on a safety case approach, similar to that specified in the UK regulatory system.

Canada

The Canada-Nova Scotia Offshore Petroleum Board (C-NSOPB) and the Canada Newfoundland & Labrador Offshore Petroleum Board (C-NLOPB) are responsible for the regulation of petroleum activities in the Nova Scotia, Newfoundland, and Labrador offshore areas. Their principle responsibilities include ensuring health and safety for offshore workers, protection of the environment, conservation of offshore petroleum resources, compliance with legislative provisions regarding employment and industrial benefits, issuance of licenses for offshore exploration and development, and resource evaluation. Both boards are independent joint agencies of the Government of Canada and their respective provinces. Each work activity proposed in the offshore area related to exploration, drilling, production, conservation, processing, or transportation of petroleum requires the authorization of the responsible board. Assurance mechanisms include board inspections, audits and investigations programs, and industry self inspections. Operators are required to submit reports detailing the status of their work programs on an ongoing basis, along with other documentation to demonstrate compliance with regulatory requirements. The C-NSOPB oversees one operational natural gas project comprised of five production platforms and one 26-inch pipeline. The C-NLOPB oversees three oil projects comprised of Floating Production Storage and Offloading units and one integrated drilling/production accommodation installation.

VI. Recommendations for Immediate Action to Improve Offshore Drilling Safety

The BP Oil Spill demonstrates the possibility of a catastrophic event (or multiple catastrophic failures) and, therefore, the need to ensure that oil and gas development on the Outer Continental Shelf can be conducted safely and that another event like the BP Oil Spill never occurs again.

This 30-day review has of necessity been conducted without the results of the ongoing investigations into the precise causes of the event. A series of other investigations will determine those causes in the coming months. Nevertheless, this report makes a set of interim recommendations based upon what is known about the equipment, systems, and practices necessary for safe operation. For example, the BP Oil Spill has underscored that as drilling activity moves increasingly into very deep water environments, it is important to reevaluate whether the best practices for safe drilling operations developed over the years need to be bolstered to account for the unique challenges of drilling in deepwater. In addition, the presumed failure of the BOP points to a need to examine standards specifically related to BOP safety.

With that context in mind, the recommendations are designed to address specific policies, practices, and procedures, which the Department has identified as important for workplace and environmental safety, even before completion of the investigation into the event. Many of the near-term recommendations are prescriptive in nature, reflecting the importance of addressing immediate needs while the Department conducts a more comprehensive examination of the entire regulatory program and determines whether additional performance-based standards are necessary.

Implementation of these recommendations is expected to improve safety of offshore drilling operations. In the coming months, these measures will be refined and supplemented based on recommendations from other reviews and investigations, including from continuing work at the Department as described below, from the Joint Investigation and from the independent bipartisan commission established by the President.

Each recommendation below is accompanied by a brief discussion of the context of the recommendations and an explanation of how it will enhance the safety of future OCS drilling activities. Each is also identified with regard to priority of expected implementation. Certain measures are intended for immediate implementation (within the next 30 days), through issuance of either a NTL, internal Departmental guidance, or in the case of a safety and environmental rule, through publication of the final rulemaking.

Other recommendations will be addressed through emergency rulemaking, where appropriate. It is the intent of the Department to issue expeditiously interim final rules to implement these recommendations. Such rules will become effective immediately upon issuance, but will also be opened for public review and comment and may be adjusted after comments are received through the appropriate process.

Finally, several recommendations require further study and, therefore, will be addressed through notice and comment rulemaking. The Department will immediately establish strike teams within the Department to further develop these measures. These strike teams will address the highly technical and complex issues raised and will seek input as appropriate from academia, industry, and other technical experts and stakeholders. The teams will present their recommendations for additional environmental protection and safety measures within six months. Recommendations will be implemented as expeditiously as possible through formal rulemaking. The recommendations from these strike teams may also inform the efforts of the President's new bipartisan National Commission.

A primer on offshore drilling technology and systems describes many of the terms used in the below recommendations (see Appendix 2).

The specific recommendations of the Department follow:

I. Blowout Preventer Equipment and Emergency Systems

BOPs and Emergency Systems: BOPs are used to control the release of oil and gas in the event of loss of well control. Current drilling regulations impose specific requirements addressing BOP systems, including requirements for annular preventers and the primary systems that control those preventers, as well as pipe and blind-shear rams.

Although the regulations do not require specific secondary control systems (back-up systems) including subsea BOP safety systems, which are designed to shut-in the wellbore automatically during emergency events the Department only approves permits for which they are secondary control systems. These safety systems include autoshear and deadman systems. Emergency events could include the loss of communication and power between the surface and the BOP stack or an unplanned disconnect of the marine riser from the BOP stack. In addition, all Gulf of Mexico drilling rigs are currently equipped to use a remote operated vehicle (ROV) to provide secondary control of the subsea BOP stack, and most provide other tertiary control systems as well. The ROV intervention capability is limited on some subsea BOP stacks while others have the ability to control multiple functions.

A. Certification of Subsea BOP Stack

Recommendation 1 – Order Immediate Re-certification of All BOP Equipment Used in New Floating Drilling Operations

Prior to spudding any new well from a floating vessel, the operator will be required to obtain a written and signed certification from an independent third party attesting that, on or after the date of this report, a detailed physical inspection and design review of the BOP has been conducted in accordance with the Original Equipment Manufacturer specifications and that: (i) the BOP will operate as originally designed, and (ii) any modifications or upgrades to the BOP stack

Defendants' Exhibit 10
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conducted after delivery have not compromised the design or operation of the BOP. This certification must be submitted to the Department and made publicly available. Prior to deploying the BOP, the operator must also verify that any modifications or upgrades to the BOP are approved by the Department and that documentation showing that the BOP has been maintained and inspected according to the requirements in 30 CFR 250.446(a) and other applicable standards and is on file with the Department and available for inspection.

Recommendation 2 – Order BOP Equipment Compatibility Verification for Each Floating Vessel and for Each New Well

For each new well, the Department will require, as part of a structured risk management process, the operator to obtain an independent third party verification that:

- The BOP stack is designed for the specific drilling equipment on the rig and for the specific well design including certification that the shear ram is appropriate for the drilling project.
- The BOP stack has not been compromised or damaged from previous service.
- The BOP stack will operate in the water depth in which it will be deployed.

Recommendation 3 – Develop Formal Equipment Certification Requirements

The Department will investigate new certification requirements for BOP equipment and other components of the BOP stack such as control panels, communication pods, accumulator systems, and choke and kill lines. In addition, the Department will develop a system to make BOP certifications publicly available in order to increase transparency and accountability.

B. New Safety Equipment Requirements and Operating Procedures

Recommendation 4 – New Blind Shear Ram Redundancy Requirement

The BOPs used in all floating drilling operations will be required to have two sets of blind shear rams spaced at least four feet apart (to prevent system failure if drill pipe joint or drill tool is across one set of rams during an emergency).

Recommendation 5 –Secondary Control System Requirements and Guidelines

The Department will establish clear requirements for secondary BOP control systems on all subsea BOPs and for systems that address well-control emergencies. These requirements will include:

- ROV intervention capabilities for secondary control of all subsea BOP stacks, including the ability to close all shear and pipe rams, close the choke and kill valves and unlatch the lower marine riser package (LMRP).

- Requirements for an emergency back-up BOP control system, e.g., autoshear, deadman, emergency disconnect system, and/or an acoustic activation system that is powered by a separate and independent accumulator bank with sufficient capacity to open and close one annular-type preventer and all ram-type preventers, including the blind shear ram.

- Guidelines for arming and disarming the secondary BOP control system.

- Requirements for documentation of BOP maintenance and repair (including any modifications to the BOP stack and control systems).

Recommendation 6 –New ROV Operating Capabilities

The Department will develop requirements for ROV operating capabilities including the following:

- Standardized intervention ports for all subsea BOP stacks to ensure compatibility with any available ROV.

- Visible mechanical indicator or redundant telemetry channel for BOP rams to give positive indication of proper functioning (e.g., a position indicator).

- ROV testing requirements, including subsea function testing with external hydraulic supply.

- An ROV interface with dual valves below the lowest ram on the BOP stack to allow well-killing operations.

C. New Testing Guidelines and Inspection Procedures

Recommendation 7 – Develop New Testing Requirements

The Department will develop surface and subsea testing of ROV and BOP stack capabilities. These will include:

- Surface and subsea function and pressure testing requirements to ensure full operability of all functions (emergency disconnect of the LMRP and loss of communication with the surface control pods (e.g., electric and hydraulic power)).

- Third party verification that blind-shear rams will function and are capable of shearing the drill pipe that is in use on the rig.

- ROV performance standards, including surface and subsea function testing of ROV intervention ports and ROV pumps, to ensure that the ROV can close all shear and pipe rams, close the choke and kill valves, and unlatch the LMRP.

- Protocols for function testing autoshear, deadman, emergency disconnect systems, and acoustic activation systems.

- Mandatory inspection and testing of BOP stack if any components are used in an emergency (e.g., use of pipe or casing shear rams or circulating out a well kick). This testing must involve a full pressure test of the BOP after the situation is fully controlled, with the BOP on the wellhead.

Recommendation 8 – Develop New Inspection Procedures and Reporting Requirements

- The Department will evaluate and revise the manner in which it conducts its drilling inspections. Revised drilling inspections will include the witnessing of actual tests of BOP equipment, including the new requirements and guidance that address the surface and subsea testing of ROV and BOP stack capabilities. The Department will also develop methods to increase transparency and public availability of the results of inspections as well as routine reporting. The Department will work with Congress to obtain the necessary resources to implement these recommendations.

- Within 15 days of the date of this report, all operators of floating drilling equipment will report to the Department the following: (i) BOP and well control system configuration; (ii) BOP and well control system test results, including any anomalies in testing or operation of critical BOP components; (iii) BOP and loss of well control events; and (iv) BOP and well control system downtime for the last three years of drilling operations.

- The electronic log from the BOP control system must be transmitted online to a secure location onshore and made available for inspection by the Department.

II. Procedures to Ensure Adequate Physical Barriers and Well Control Systems are in Place to Prevent Oil and Gas from Escaping into the Environment

Minimizing Risk of Uncontrolled Flow: A well creates a conduit for subsurface formations to potentially flow uncontrolled to the surface. There are multiple methods that can be utilized to minimize the risk of the occurrence of uncontrolled flow. Those methods include the installation of rigid physical barriers such as cement plugs or mechanical plugs, well casing design and securing of the casing, and well control equipment. An appropriate well safety program must account for many factors unique to the drill location and dictates the installation of plugs and casing at strategic points to maintain well control and to enable drilling to the desired depth. Current Department regulations require that well-control equipment be in place at all times during the drilling operation to mitigate against failure of a plug or casing. Other, more specific standards may be appropriate to improve physical barriers and well-control systems. Well-control procedures must be revisited for deepwater operations because of the complexity of the equipment design in deepwater and the location of the BOP stack on the seafloor. Enhanced training for rig personnel will complement new well-control requirements.

A. Well-Control Guidelines and Fluid Displacement Procedures

Recommendation 1 – Establish Deepwater Well-Control Procedure Guidelines

As expeditiously as possible, the Department will establish new requirements for deepwater well-control procedures no later than 120 days of the date of this report.

Recommendation 2 – New Fluid Displacement Procedures

Prior to displacement of kill-weight drilling fluid from the wellbore, the operator must independently verify that:

- The BOPs are closed during displacement to underbalanced fluid columns to prevent gas entry into the riser should a seal failure occur during displacement.

- Two independent barriers, including one mechanical barrier, are in place for each flow path (i.e., casing and annulus), except that a single barrier is allowable between the top of the wellhead housing and the top of the BOP.

- If the shoe track (the cement plug and check valves that remain inside the bottom of casing after cementing) is to be used as one of these barriers, it is negatively pressure tested prior to the setting of the subsequent casing barrier. A negative pressure test must also be performed prior to setting the surface plug.

- Negative pressure tests are made to a differential pressure equal to or greater than the anticipated pressure after displacement. Each casing barrier is positively tested to a pressure that exceeds the highest estimated integrity of the casing shoes below the barrier.

- Displacement of the riser and casing to fluid columns that are underbalanced to the formation pressure in the wellbore is conducted in separate operations. In both cases, BOPs must be closed on the drill string and circulation established through the choke line to isolate the riser, which is not a rated barrier. During displacement, volumes in and out must be accurately monitored.

- Drill pipe components positioned in the shear rams during displacement must be capable of being sheared by the blind-shear rams in the BOP stack.

B. Well Design and Construction

1. Requirements for Both Casing and Cementing

Recommendation 3 – New Casing and Cement Design Requirements: Two Independent Tested Barriers

Before spudding any new floating drilling operation, all well casing and cement designs must be certified by a Professional Engineer, who verifies that there will be at least two independent tested barriers, including one mechanical barrier, across each flow path during well completion and abandonment activities and that the casing design is appropriate for the purpose for which it is intended under reasonably expected wellbore conditions.

Recommendation 4 – Study Formal Personnel Training Requirements for Casing and Cementing Operations

The Department will immediately establish a technical workgroup to evaluate new training and certification requirements for rig personnel specifically related to casing and cementing operations.

2. Casing Requirements

Recommendation 5 – New Casing Installation Procedures

The Department will ensure the requirement of the following BAST practices:

- Casing hanger latching mechanisms or lock down mechanisms must be engaged at the time the casing is installed in the subsea wellhead.

- For the final casing string, the operator must verify the installation of dual mechanical barriers (e.g., dual floats or one float and a mechanical plug) in addition to cement, to prevent flow in the event of a failure in the cement.

Recommendation 6 – Develop Additional Requirements or Guidelines for Casing Installation

The Department will establish specific requirements for the following procedures and practices:

- Positive and negative test procedures and use of test results for evaluation of casing integrity.

- Use of float valves and other mechanical plugs in the final casing string or liner.

3. Cementing Requirements

Recommendation 7 – Enforce Tighter Primary Cementing Practices

- The Department will institute a rulemaking address previously identified gaps in primary cementing practices).

- The Department, with input from independent experts will determine specific cementing requirements.

Recommendation 8 – Develop Additional Requirements or Guidelines for Evaluation of Cement Integrity

The Department will immediately evaluate whether and under what circumstances the use of cement bond logs is feasible and practical and will increase safety.

Discussion of Recommendations 3-8

Recommendations 3-8 are intended to result in better well control. Requiring a Professional Engineer to review and certify the well design will add another level of review to the current well design requirements. The Department's review new training requirements for casing and cementing operations helps focus industry and rig personnel on the importance of proper casing and cementing operations. Additional operational requirements for casing installation and cementing operations will add new assurances that adequate barriers are in place before continuing on to new drilling activities. Incorporation of the new cementing standard will bring all of industry up to state-of-art cementing practices—this means less chance of a well blowout due to a poor cement job.

C. Wild-Well Intervention

Recommendation 9 – Increase Federal Government Wild-Well Intervention Capabilities

Blown out, or "wild" wells, involve the uncontrolled release of crude oil or natural gas from an oil well where pressure control systems have failed. The Federal Government must develop a plan to increase its capabilities for direct wild-well intervention to be better prepared for future emergencies, particularly in deepwater. Development of the plan should consider existing methods to stop a blowout and handle escaping wellbore fluids, including but not limited to coffer dams, highly-capable ROVs, portable hydraulic line hook-ups, and pressure-reading tools, as well as appropriate sources of funding for such capabilities.

Recommendation 10 – Study Innovative Wild-Well Intervention, Response Techniques, and Response Planning

The Department will investigate new methods to stop a blowout and handle escaping wellbore fluids. A technical workgroup will take a fresh look at how to deal with a deepwater blowout. In particular, the workgroup will evaluate new, faster ways of stopping blowouts in deepwater. The technical workgroup will also address operators' responsibility, on a regional or industry-wide basis, to develop and procure a response package for deepwater events, to include diagnostic and measurement equipment, pre-fabricated systems for deepwater oil capture, logistical and communications support, and plans and concepts of operations that can be deployed in the event of an unanticipated blowout, as well as assess and certify potential options (e.g., deepwater dispersant injection).

III. Organizational and Safety Management

A. Increased Enforcement of Existing Safety Regulations and Procedures

Enforcing Existing Regulations: Immediately following the BP Oil Spill, the MMS and the U.S. Coast Guard issued a joint Safety Alert to compel operators and drilling contractors to inspect their drilling equipment (both surface and subsea), review their procedures to ensure the safety of personnel and protection of the environment, and review all emergency shutdown and dynamic positioning procedures. Inspections began immediately to verify that all active deepwater drilling activities complied with these recommendations and all other regulations. Following the completion of the drilling inspections, inspections of all deepwater production facilities began immediately to ensure compliance by those facilities with the regulations. Reconfirmation of adherence to this Safety Alert and all existing regulations will heighten safety awareness.

Recommendation 1 – Compliance Verification for Existing Regulations and April 30, 2010, National Safety Alert

Within 30 days of the date of this report, the Department, in conjunction with the Department of Homeland Security, verify compliance by operators with existing regulations and National Safety Alert (issued April 30, 2010), which issued the following safety recommendations to operators and drilling contractors:

- Examine all well-control equipment (both surface and subsea) currently being used to ensure that it has been properly maintained and is capable of shutting in the well during emergency operations. Ensure that the ROV hot-stabs are function-tested and are capable of actuating the BOP.

- Review all rig drilling/casing/completion practices to ensure that well-control contingencies are not compromised at <u>any</u> point while the BOP is installed on the wellhead.

- Review all emergency shutdown and dynamic positioning procedures that interface with emergency well control operations.

- Inspect lifesaving and firefighting equipment for compliance with Federal requirements.

- Ensure that all crew members are familiar with emergency/firefighting equipment, as well as participate in an abandon ship drill. Operators are reminded that the review of emergency equipment and drills must be conducted after each crew change out.

- Exercise emergency power equipment to ensure proper operation.

- Ensure that all personnel involved in well operations are properly trained and capable of performing their tasks under both normal drilling and emergency well-control operations.

After the 30-day compliance period, the Department will provide a public report on operator verification, including any cases of non-compliance.

B. Organizational Management

Organizational Safety Case Documentation: A safety case is a comprehensive and structured set of safety documentation to ensure the safety of a specific vessel or equipment. This documentation is essentially a body of evidence that provides a basis for determining whether a system is adequately safe for a given application in a given environment. In response to the 1988 Piper Alpha disaster in the UK, the Lord Cullen investigation and report advanced the safety case concept for offshore oil and gas operations.

The use of a formal safety case for drilling operations is an important component in regulating drilling activities in many countries. The International Association of Drilling Contractors (IADC) has developed guidelines that can be applied to any drilling unit regardless of geographic location. The use of these guidelines can assist both the operator and regulatory authorities when evaluating a drilling contractor's safety management program by providing them assurance that the program encompasses a series of best industry practices designed to minimize operating risks. The Department will undertake an evaluation of requiring the application of all or part of these guidelines to OCS oil and gas operations.

Recommendation 2 – The Department Will Adopt Safety Case Requirements for Floating Drilling Operations on the OCS

The Department will assure the adoption of appropriate safety case requirements based on IADC Health, Safety and Environmental Case Guidelines for Mobile Offshore Drilling Units (2009), which will include well construction safety assessment prior to approval of APD. This safety case must establish risk assessment and mitigation processes to manage a drilling contractor's controls related to the health, safety, and environmental aspects of their operations. In addition to the safety case, a separate bridging document will be required to connect the safety case to existing well design and construction documents. Such a proposed Well Construction Interfacing Document will include all of the elements in a conventional bridging document plus alignment of the drilling contractor's management of change (MOC) and risk assessment to the lease operator's MOC and well execution risk assessments. The use of the IADC's Health, Safety, and Environmental Case Guidelines for Mobile Offshore Drilling Units will help operators and drilling contractors demonstrate their ability to operate safely and handle the risks associated with drilling on the OCS.

C. Personnel Accountability Procedures for Operational Safety (Risk, Injury, and Spill Prevention)

Recommendation 3 – Finalize a Rule that Would Require Operators to Develop a Robust Safety and Environmental Management System for Offshore Drilling Operations

Department investigation findings and reports indicate that unsafe offshore drilling operations often result from human error. The Department is proceeding with the rulemaking process to finalize a regulation to require operators on the OCS to adopt a comprehensive, systems-based approach to safety and environmental management that incorporates best practices from around the globe. The Department believes that requiring operators to implement robust and comprehensive safety and environmental management plans could reduce the risk and number of injuries and spills during OCS activities. The Department will finalize a rule that is informed by current operational conditions in the Gulf and the events and related investigation surrounding the BP Oil Spill.

Recommendation 4 – Study Additional Safety Training and Certification Requirements

The Department will immediately establish a workgroup to investigate safety training requirements for floating drilling rig personnel and possible requirements for independent or more frequent certification and testing of personnel and safety systems.

- Establish an oil production safety program or institute similar to U.S. Nuclear Regulatory Commission (NRC) reactor safety program.

- Establish a formalized analytical methodology to assess performance of safety systems in the event of multiple component failure or excursions outside normal environmental ranges.

- Strengthen technical support to the Department and other regulatory authorities, including the resources necessary to obtain independent technical review of regulations and standards.

- Charter a longer-term technical review of BOP equipment and emergency backup system reliability.

- Review and adopt as appropriate best practices from other agencies with similar responsibility for safety regulation of technically complex systems (e.g., Federal Aviation Administration, NRC, Chemical Safety Board, and National Transportation Safety Board).

VII. Conclusion

The Department developed these recommendations with input and suggestions from experts from across the field and reviewed by members of the National Academy of Engineering. The

Department has presented new requirements for well design, construction and operation and for the quality and sufficient redundancy of fail-safes, so as to promote better well control and ensure the efficacy of the BOPs. The Secretary of the Interior has directed the Department to develop measures to increase the frequency, thoroughness, and transparency of inspections, such as for testing of BOPs and associated back-up systems. The Secretary has also directed the Department to look at innovative ways of promoting a greater culture of safety through a new rule that would require all rig operators to develop enhanced operational, safety, and environmental management plans, which would include more extensive worker training to enable them to adapt and respond effectively to events when something unexpected happens on a drilling rig.

The Department's approach to implementing these recommendations will follow a continuum from near-term prescriptive regulations, which are required to increase immediately the margin of safety in offshore oil and gas development, to longer-term actions designed to facilitate an environment where the absolute highest standard of performance is demanded of industry. This approach puts the onus on industry to perform safely, with the Government focusing on aggressive verification and enforcement. The majority of the specific recommendations contained in this report fall within the category of near-term prescriptive actions necessary to increase offshore energy production safety immediately.

At the same time, the Secretary has directed a fundamental restructuring of the MMS to bring greater clarity to the roles and responsibilities of the Department while strengthening oversight of the companies that develop energy in our Nation's waters. This restructuring, the latest in a series of reforms to the MMS that the Secretary began in January 2009, will establish:

- Bureau of Ocean Energy Management: A new bureau under the supervision of the Assistant Secretary for Land and Minerals Management that will be responsible for the sustainable development of OCS conventional and renewable energy resources, including resource evaluation, planning, and other activities related to leasing.

- Bureau of Safety and Environmental Enforcement: A bureau under the supervision of the Assistant Secretary for Land and Minerals Management that will be responsible for ensuring comprehensive oversight, safety, and environmental protection in all offshore energy activities.

- Office of Natural Resources Revenue: An office under the supervision of the Assistant Secretary for Policy, Management and Budget that will be responsible for the royalty and revenue management function including the collection and distribution of revenue, auditing and compliance, and asset management.

Another critical part of the ongoing effort to reform the MMS began in September 2009 when the Secretary asked the National Marine Board, an arm of the highly respected National Academy of Sciences, to direct an independent review of MMS's inspection program for offshore facilities. That review is on-going.

The Secretary is committed to implementing the changes recommended in this report at the same time this and other reviews are ongoing and at the same time that the Department undertakes fundamental change in its OCS oversight. The Secretary established by Secretarial Order 3298 the OCS Safety Oversight Board. The OCS Safety Oversight Board is a high-level team, led by the Assistant Secretary for Land and Minerals Management, the Assistant Secretary for Policy, Management and Budget, and the Inspector General, that reviews and oversees OCS operations to support reasoned and fact-based recommendations for potential improvements.

The success of the Department's longer-term objective of creating a more dynamic and effective regulatory environment for offshore energy production overall is very much the focus of the efforts to restructure the MMS. Specifically, the persons responsible for designing the new Bureau of Safety and Environmental Enforcement have been tasked to create a structure, operational processes, and culture that supports both the longer-term recommendations contained in this report, as well as a continuously evolving set of additional policies and practices that provide the highest assurance of safety in offshore energy operations.

As the Presidential Commission completes its review and as the Department and the U.S. Coast Guard finish the root cause investigation, the Department will know more and will respond accordingly. The measures contained in this report will increase the safety in offshore oil and gas development, but represent only the beginning of the Department's work.

Appendix 1: Expert Consultations

The Department consulted with a wide range of experts in state and Federal governments, academic institutions, and industry and advocacy organizations. In addition, draft recommendations were peer reviewed by seven experts identified by the National Academy of Engineering.

Expert Reviewers of the National Academy of Engineering

- **Bea, Robert** holds a Bachelor of Science in Civil Engineering and a Master of Science in Engineering both from the University of Florida. Dr. Bea has done post-graduate studies at Tulane University, Rice University, Texas A&M University, Bakersfield College, University of Houston, and the Technical and Scientific University of Norway. Dr. Bea received a PhD from the University of Western Australia. He is a registered Professional Civil Engineer (retired) in Louisiana, Texas, Florida, Alaska, Washington, Oregon and California. He is a registered Professional Geotechnical Engineer (retired) in California. He is a member of the American Society of Civil Engineers, the American Society of Mechanical Engineers, and the National Academy of Engineering. Dr. Bea has 55 years of experience in engineering and management of design, construction, maintenance, operation and decommissioning engineered systems, including offshore platforms, pipelines and floating facilities. Dr. Bea has worked for the U.S. Army Corp of Engineers, Shell Oil Company, the Ocean Services Division of Woodward-Clyde Consultants, PMB Engineering – Bechtel Inc., and the University of California at Berkeley where he is currently a professor. In 2009, he was honored by the Offshore Technology Hall of Fame.

- **Brett, Ford** holds a Bachelor of Science in mechanical engineering and physics from Duke University as well as a Master of Science in Engineering from Stanford University and a Masters of Business Administration from Oklahoma State University. Mr. Brett is recognized as a leader in the area of Petroleum Project Management. He has consulted more than 25 countries in the area of petroleum project and process management. Formerly, Mr. Brett worked with Amoco Production Company where he specialized in drilling projects in the Bering Sea, North Slope of Alaska, Gulf of Mexico, offshore Trinidad and Wyoming. In 1996, Mr. Brett was nominated for the National Medal of Technology, the U.S. Government's highest technology award. Mr. Brett has been granted over 25 U.S. patents.

- **Baugh, Benton** holds a Bachelor of Science in Mechanical Engineering from the University of Houston; a Master of Science in Mechanical Engineering and PhD in Mechanical Engineering from Kennedy Western University. Additionally, Dr. Baugh graduated from the Army Machinist School. Dr. Baugh has been employed by Bowen, Camco, Cameron, Vetco, Brown Oil Tools, and Baugh Consulting Engineers. Dr. Baugh is the owner and President of Radoil, Inc., which designs and manufactures oilfield and subsea products. Dr. Baugh has received over 100 U.S. patents for his tool and solution designs, consulting and management. Dr. Baugh has over 50 years of oilfield machine design, manufacturing, management, consulting, and expert witness experience.

- **Chenevert, Martin** holds a Bachelor of Science in Petroleum Engineering from Louisiana State University as well as a Master of Science in Petroleum Engineering and a Doctor of Philosophy in Petroleum Engineering, both from the University of Texas at Austin. Dr. Chenevert has over ten years of industrial experience with Exxon Production Research and Exxon USA and over 30 years of teaching experience from Oklahoma State University, the University of Houston, and the University of Texas. Dr. Chenevert has published over 120 articles on well control, wellbore stability, rock mechanics, drilling fluids, and cementing.

- **Holand, Per** graduated from Norwegian University of Science and Technology in 1982 with a Master of Science in Mechanical Engineering. He has 18 years experience from safety and reliability engineering at SINTEF, prior to joining ExproSoft on May 1, 2001. His main work focus in SINTEF and ExproSoft has been on the reliability of drilling equipment, offshore blowout experience, subsea and well reliability analyses. Dr. Holand carried out numerous subsea BOP reliability studies on behalf of clients in Norway, Brazil, the United States, and Italy. Since 1990 he has been responsible for maintaining the SINTEF Offshore Blowout Database, which serves as the key information in connection with blowout risk analyses in the North Sea area. Dr. Holand holds a PhD (1996) in safety and reliability engineering from the Norwegian University of Science and Technology in Trondheim, Norway. His PhD was later reworked and published as a book at the Gulf Publishing Company in 1997 (Title: Offshore Blowouts, Causes and Control).

- **Juvkam-Wold, Hans** holds a Bachelor of Science, Master of Science, and a Doctor of Science in Mechanical Engineering from the Massachusetts Institute of Technology. His area of expertise is buckling of tubular in horizontal drilling, well control, Arctic and offshore drilling, and dual-gradient drilling in ultra-deep water. Dr. Juvkam-Wold is a Registered Professional Engineer in Texas. Prior to his 24 years of teaching drilling experience at the University of Texas A&M, Dr. Juvkam-Wold has 20 additional years of oil industry experience: Juvkam-Wold has served as a Consultant for the National Institute of Standards & Technology; Frontier and Offshore Technology Co.; Western Irrigation Supply House; Oil & Gas Consultants Inc.; Ocean Drilling Program; Unocal E&P. He has served as the Gulf Mineral Resources Company's Representative on the industry's advisory committee on mine shaft drilling as well as manager of technical services and section supervisor of production engineering. Dr. Juvkam-Wold joined Texas A&M in 1985 with his main area of teaching and research in drilling; he is now a Professor Emeritus of Petroleum Engineering. Dr. Juvkam-Wold holds seven drill-related U.S. patents.

- **Stancell, Arnold** holds a Doctor of Science in Chemical Engineering from the Massachusetts Institute of Technology. Dr. Stancell is the retired Vice president of Mobil Oil, Exploration and Production, and Professor Emeritus, Chemical Engineering, Georgia Tech. Dr. Stancell was awarded nine U.S. patents and was inducted into the National Academy of Engineering and received the AIChE's National Award in Chemical

Engineering Practice. He is a licensed Professional Engineer in New York and Connecticut.

Other Experts Consultations

- **Arnold, Ken** holds a Bachelor of Science in Civil Engineering from Cornell University and a Master of Science in Civil Engineering from Tulane University. Mr. Arnold is currently a registered Professional Engineer in the State of Texas, is a member of the Marine Board of the National Research Council, Society of Petroleum Engineers, the Texas Society of Professional Engineers, was elected to the National Academy of Engineers in 2005 due to his work on offshore safety and is a member of the Academy of Medicine, Engineering and Science of Texas.

- **Danenberger, Elmer "Bud"** holds a Bachelor of Science degree in Petroleum and Natural Gas Engineering and a Master's degree in Environmental Pollution Control, both from Pennsylvania State University. After a 38-year career, Mr. Danenberger retired from the Department of the Interior's offshore oil and gas program in January 2010. During his career, Mr. Danenberger served as a staff engineer in the Gulf of Mexico regional office, Chief of the Technical Advisory Section at the headquarters office of the U.S. Geological Survey, District Supervisor for several MMS offices, and Chief of the Engineering and Operations Division at MMS Headquarters. For the last five years of his tenure at the Department, he served as Chief, Offshore Regulating Programs with responsibilities for safety and pollution prevention research, investigations, regulations and standards, and inspection and enforcement programs.

- **Epstein, Lois** holds a Bachelor of Science in Mechanical Engineering from Massachusetts Institute of Technology and a Master of Science in Mechanical Engineering from Stanford University. Ms. Epstein is currently a licensed engineer in Maryland. Ms. Epstein is a former Senior Engineer, Cook Inlet Keeper. Ms. Epstein is the President of LNE Engineering and Policy, which provides technical and policy consultant to non-profit organizations on oil/gas issues. Ms. Epstein was a public member of the Office of Pipeline Safety Federal Advisory Committee on Hazardous Liquid Pipelines from 1995 through 2007.

- **O'Reilly, David J.** is the retired Chairman and Chief Executive Officer of Chevron Corporation. Mr. O'Reilly is a native of Dublin, Ireland, where he earned his Bachelor's degree in Chemical Engineering from the University College, Dublin. Mr. O'Reilly started as a process engineer with Chevron Research Co in 1968 and after several decades and earning positions of increasing responsibility he was elected Senior Vice President and Chief Operating Officer of Chevron Chemical Company in 1989. Mr. O'Reilly was named Chairman and Chief Executive Office of Chevron Corporation on January 1, 2000, and he held that position until his retirement on December 31, 2009. Mr. O'Reilly is the Vice Chairman of the National Petroleum Council. He is a director of Bechtel Group, Inc., a member of The Business Council, the World Economic Forum's International Business Council, and the American Society of Corporate Executives. He also serves on the San Francisco Symphony Board of Governors.

- **Regg, Jim** holds a Bachelor of Science in Petroleum and Natural Gas Engineering from Pennsylvania State University as well as a Bachelor of Art in Math/Science from Edinboro State University. Mr. Regg worked for the Minerals Management Service Field Operations for almost 20 years where his primary focus was technology assessment. Currently Mr. Regg is a Senior Petroleum Engineer for the Alaska Oil & Gas Conservation Commission where he is responsible for managing the compliance inspection program (including investigations and enforcement); well integrity and regulation development.

- **Ward, E.G. "Skip"** holds a Bachelor of Science in Mechanical Engineering from Lamar University and a Master's and Doctorate in Mechanical Engineering from the University of Houston. Dr. Ward spent 30 years with Shell Oil Co. beginning in Shell Development's E&P Research Division in 1968 as a researcher. From 1981 to 1985, he supervised the Oceanographic Engineering section. From 1985 through 1994, he managed the Offshore Engineering Research Department. In 1994, Dr. Ward became the technology manager of Shell Offshore Inc's Deepwater Division where he was responsible for a group that designed deepwater structures and developed new structural concepts and components for deepwater production systems. Dr. Ward has been a member of the American Petroleum Institute since 1976 and received API's 30+ Years of Service Recognition Award in 2006. Dr. Ward served on the Marine Board of the National Academies for nine years. Dr. Ward is currently the Associate Director of the Texas Engineering Experiment Station's Offshore Technology Research Center.

- **West, Robin** is the current Chairman, Founder, and Chief Executive Officer of PFC Energy where he advises chief executives of leading international oil and gas companies and national oil companies on corporate strategy, portfolio management, acquisitions, divestitures, and investor relations. Before founding PFC Energy in 1984, Mr. West was the Assistant Secretary of Policy, Management and Budget at the Department of the Interior from 1981 through 1983. While there, he conceived of and implemented the Outer Continental Shelf Leasing Schedule and managed the $14 billion per year OCS budget policy. Mr. West also served as the Deputy Assistant Secretary of Defense for International Economic Affairs during the Ford Administration. Mr. West has served on several boards and commissions including a Presidential appointment to the National Advisory Committee on Oceans and Atmosphere in 1977. Mr. West is also a member of the National Petroleum Council; Director of the Magellan Petroleum Corporation; Director of Key Energy Services, Inc and Director of Cheniere Energy. He earned his Bachelor of Arts from the University of North Carolina at Chapel Hill and a Juris Doctorate from Temple University.

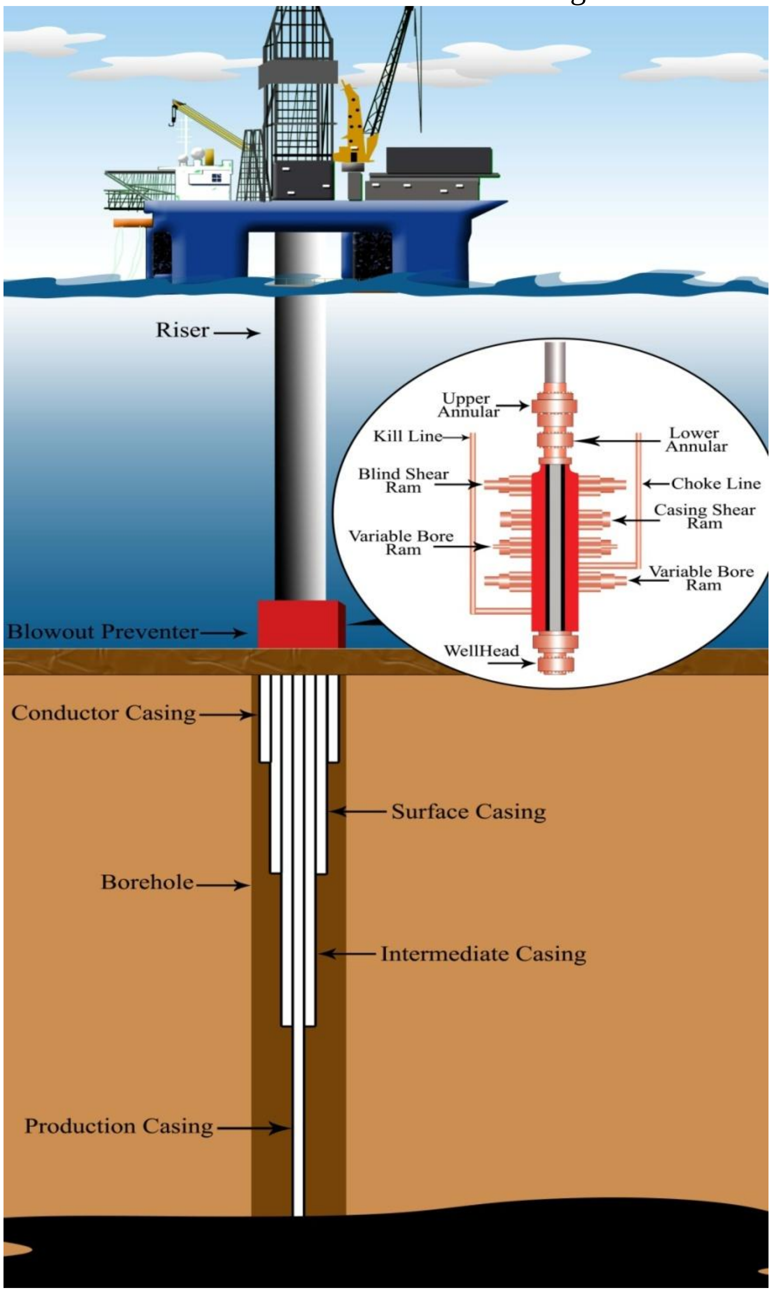
- **Williams, Tom** has been in the energy business for over 28 years. He is currently the Managing Director of Nautilus International LLC. Mr. Williams served as President of Maurer Technology Inc, a leading drilling research and development and engineering technology company. From 1993 through 2000, he was Business Director at Westport Technology Center, a leading upstream oil and gas research company. Mr. Williams held senior executive positions at the Departments of the Interior and Energy during the Bush

Administration from 1989 through 1993. He owned and operated an oil and gas exploration, production and consulting company prior to joining the Department of Energy. Mr. Williams is currently on the Board of Directors of Far East Energy Corporation, a public oil and gas company with operations in China; Board of Directors of Petris Technology, Inc, TerraPlatforms LLC; The Research Partnership to Restore Energy for America; The Contributor Committee Co-Chair of DeepStar Consortium; The Society of Petroleum Engineers; The Independent Petroleum Association of America; The International Association of Drilling Contractors; the American Association of Drilling Engineers. Mr. Williams' Environmentally Friendly Drilling Project was awarded the Environmental Stewardship Award by the Interstate Oil and Gas Compact Commission in May of 2010.

Appendix 2: Brief Primer on Offshore Drilling Technology and Systems

The process for an offshore oil and gas exploratory well begins by positioning a drill rig above the intended leasing tract for exploration (see Figure A1).

Figure A1
Schematic of Offshore Drilling



Source: Minerals Management Service Database, 2010.

Defendants' Exhibit 10
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The rig lowers drill pipe (also known as a drill string) with a drill bit attached to its end to the seafloor where it commences to drill. The borehole created by the drill is then set with casing. At the seafloor, conductor casing is normally set to stabilize the soft sediments at the top of the borehole to ensure that continued drilling does not precipitate a borehole collapse. Once the conductor is in place, the drill rig lowers to the seafloor a marine riser (a large pipe that surrounds the drill pipe) that connects the conductor casing to the drill rig. As drilling proceeds, a blowout preventer (BOP) is lowered to the seafloor and sits atop the wellhead.

As drilling progresses with depth, additional casings (sections of pipe) that are slightly narrower in diameter than the hole created by the drill bit are inserted into the borehole and bonded into place by "cement." This process ensures that the borehole does not collapse on itself, and it isolates the borehole from any pockets of gas or water in the strata that the borehole passes through. A series of casings of equal diameter that are connected together and run down the borehole is a "string" and a string may be hundreds to thousands of feet long with a threaded connector between each 30-foot segment of casing. Deeper into the borehole, narrower casings are inserted one into the other resulting in strings of casing that are enclosed and cemented into the previous, slightly wider-diameter string of casing. The outermost casing can be up to four feet in diameter with the innermost string of casing less than six inches in diameter in some cases. The initial and final casing diameters, the types of casing, and type of cement used are determined by the profile (depth, temperature, pressure, etc.) of the well being drilled. Once the well is in production, the hydrocarbons will come to the surface through the production casing that is run down through the middle of the narrowest casing string.

During the process of drilling, drill fluid, referred to as "mud," is pumped down the drill pipe through drill bit nozzles. The mud's primary function is maintaining "well control," but it also cools the drill bit and carries the drill cuttings away from the bottom of the borehole and returns to the surface through the space (the annulus) between the drill pipe and the walls of the casing strings. To maintain well control, the pressure created by the weight of the mud in the drill pipe and annulus must be maintained equal to or greater than the pressures encountered in the borehole. Various indicators of well pressure measures allow the mud engineer on the rig to maintain the well bore fluid pressure equal to or slightly greater than the pressures from the deepest formation. This type of pressure balance is called overbalanced.

The pockets of oil, gas, or water that are encountered in porous layers during the drilling process can suddenly push the mud through the annulus with considerable pressure—what is referred to as a "kick." When a kick occurs there are various bypass mechanisms, such as diverters and BOPs, to shunt the pressure away from the well bore (diverter) or prevent the pressure from rising to the ocean surface (BOP), thereby maintaining well control. If a kick overwhelms the control mechanisms, a blowout can occur.

A BOP consists of a series of ram and annular preventers that sits atop the wellhead and connects to one of the outermost casing strings, allowing the narrower casing strings and drill pipe to be lowered down the borehole through the center of the BOP. In the event of significant loss of well control, one or more of the preventers can be activated from the drill rig. The annular preventer is typically the first to be utilized when an influx from a formation is experienced, but is not usually used with pressures above 3,500 pounds per square inch (psi). The pipe (variable bore) rams are utilized for pressures above 3,500 psi. A pipe ram and/or annular preventer will be closed around the drill pipe shutting off the upward movement of mud and pressure through the annulus between the drill pipe and the casing string. A blind-shear ram can be used to cut through the entire drill pipe and seal the borehole. In the event that activation from the drill rig fails, BOPs may have one or more back-up means for activating the rams. Remote operated vehicles (ROVs) can trigger closure of the rams working at the BOP. Other redundant control systems include “acoustic switch” technology which can activate the BOP with an acoustic signal from the rig through the water. Another device called a “deadman” switch automatically closes rams if the BOP loses connection electronic or hydraulic communication with the drill rig for any reason.

The BOPs are a hydraulically activated device. The hydraulics are supplied by the accumulator system located on the rig through lines that run down the riser and connect to the BOP. The BOP contains control devices called pods which are blue and yellow. The hydraulic fluid is distributed by the pod to the desired components of the BOP. The communication system to the pod may either be a pilot hydraulic system or an electro-hydraulic system. The pilot hydraulic system uses hydraulic pressure to function the pod and the electro-hydraulic system uses electrical signals to communicate with the pod. All commands for the system are sent from the control panel on the rig. The subsea BOP also contains pre-charged bottles that provide hydraulic fluid to activate the BOP’s auto shear or deadman devices in the event of disconnects. The BOP is also equipped with an ROV “hot stab” panel that allows the hydraulic line(s) from the accumulator system to be isolated in order for the ROV to “stab” in a separate control line and directly pump into the BOP to function the rams via a pump mounted on the ROV. The panel for the ROV to “stab” into may be capable of activating all rams or only designated ram(s).