

The Ultra-Deepwater Advisory Committee
Advisory Committee to The Secretary of Energy

April 11, 2011

The Honorable Steven Chu
Secretary of Energy
Washington, D.C. 20585

Dear Mr. Secretary:

On behalf of the Ultra-Deepwater Advisory Committee (UDAC) I would like thank you for your support as we offer comments and recommendations on the 2011 Annual Plan and its impact upon one of our most important strategic resources. Energy independence, sustainability, and reducing imports are important for long-term economic stability of the United States of America. Our country's energy supply depends strongly upon continued exploration and production from deepwater areas within the US. Recent production (2009) of oil from US deepwater Gulf of Mexico has reached nearly one-third of total US production. However, lessons emerging from the *Deepwater Horizon* incident are revealing the need for a meaningful review of ultra-deepwater exploration and production activities. This review must include more thorough research into risk identification, analysis and management; failure, accident and spill prevention; and spill containment and cleanup methodologies. Application of technology can be a double-edged sword. In the hands of well trained experts with good procedures, advanced technologies allow greater access to resources with greater efficiency and reliability. This is extremely relevant to extraction of energy from offshore ultra-deepwater environments. On the other hand these facilitating technologies can expose humans and the environment to new risks that must be managed.

In response to the potential for new risks UDAC has:

- Established a new subcommittee to specifically address risk assessment,
- Identified and prioritized new Research Portfolio areas which address technology or knowledge gaps specifically related to safety, environmental impact assessment, and environmental impact mitigation, and
- Recommended Program Process improvements to access new skill sets and accelerate the growth of the knowledge base.

To promote and address the goal of reducing risk and improving safety there is a need for increased cooperation between stakeholders within the offshore industry to share accepted best practices and potentially, research efforts.

The Committee recommends the Department of Energy continue advancing the program and identify avenues to increase funding, especially in light of the directional change in the program. Please find enclosed the UDAC Report of findings and recommendations.

A handwritten signature in black ink, appearing to read "Dan Daulton". The signature is fluid and cursive, with a large initial "D" and a long horizontal stroke at the end.

Respectfully submitted,
Ultra-Deepwater Advisory Committee Chair
Dan Daulton

Ultra-Deepwater Advisory Committee

2011 Annual Plan

Comments, Findings and Recommendations

April 2011

An Advisory Committee to the Secretary of Energy

Ultra-Deepwater Advisory Committee Report

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1.0 INTRODUCTION

The Ultra-Deepwater Advisory Committee (UDAC or Committee) was formed pursuant to the provisions of Title IX, Subtitle J, Section 999D(a) of the 2005 Energy Policy Act (EPAct).

The Committee consists of:

- Individuals with extensive research experience or operational knowledge of offshore natural gas and other petroleum exploration and production; and
- Individuals broadly representative of the affected interests in ultra-deepwater natural gas and other petroleum production, including interests in environmental protection and safe operations.

The provisions of EPAct excluded Federal employees and board members, officers or employees of the Program consortium, known as Research Partnership to Secure Energy for America (RPSEA; or the Consortium).

The duties of the UDAC under EPAct Title IX, Subtitle J, Section 999D(a) are to advise the Secretary of Energy (Secretary) on the development and implementation of programs under Title IX, Subtitle J, related to ultra-deepwater (UDW) natural gas and other petroleum resources and to carry out section 999B(e)(2)(B) which is to comment on the draft annual plan.

See Section 4.0 for a list of Committee members.

The Department of Energy (DOE) Designated Federal Officer and the Secretary provided additional guidance for the Draft 2011 Annual Plan (the Plan) Review at the 14th Meeting of UDAC in Washington, DC on February 23, 2011.

The schedule of work for the review of the 2011 Plan included the following key milestones:

- 2-23-11 14th UDAC Meeting, Washington, DC: Convene UDAC, began initial review of the Program Consortium Draft 2011 Annual Plan (July 2010) and Department of Energy 2011 Annual Plan (Sept 2010), vote to maintain 2 Standing Subcommittees: the UDAC R&D Portfolio Subcommittee, and the UDAC R&D Program Process Subcommittee, assign membership to standing Subcommittees
- 3-2011 Meetings of the UDAC R&D Portfolio Subcommittee: reviews charter, identify R&D gaps, findings and recommendations, and create Subcommittee report.

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- 3-2011 Meetings of the UDAC R&D Program Process Subcommittee: review and refine charter, discusses program process, identify findings and recommendations, and create Subcommittee report.
- 4-6/7-11 15th UDAC Meeting, Houston, TX: review Subcommittee reports; develop final findings and recommendations
- 4-8-2011 Meeting of the UDAC Editing Subcommittee: develops draft of UDAC Final Report on the *2011 Annual Plan*
- 4-13-2011 UDAC Editing Subcommittee delivers draft of UDAC Final Report to the UDAC members prior to final vote
- 04-19-2011 16th UDAC Meeting, Washington, DC: members vote to accept final UDAC report of comments, findings and recommendations on the *2011 Annual Plan*

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2.0 EXECUTIVE SUMMARY

The UDAC wishes to thank Secretary Chu for personally addressing our February 23th meeting, providing insight, concerns and desires for the Program's future. The UDAC extends appreciation to the teams responsible for planning and executing the Ultra-Deepwater (UDW) Program: the DOE, National Energy Technology Laboratory (NETL) and Research Partnership to Secure Energy for America (RPSEA; or the Consortium). We encourage the teams to contribute an additional measure of cooperation as the Program makes adjustments following the tragic event of the *Deepwater Horizon*. In addition, the UDAC unanimously voted to create a new Subcommittee to assist with communication and direction with respect to risk assessment associated with offshore oil and gas activities.

3.0 SUBCOMMITTEE REPORTS

The UDAC maintained the formation of two standing subcommittees (R&D Program Portfolio and Program Process) to further review focus areas of the 2011 Draft Plan and offer suggestions to be considered with proposed change in the Plan direction. The following are highlights the Committee wishes to report.

3.1 R&D PORTFOLIO FINDINGS AND RECOMMENDATIONS

Overview

As stated in the 2011 Annual Plan for the Ultra-Deepwater (UDW) and Unconventional Natural Gas and Other Petroleum Resources Research and Development Program, the proposed Ultra-Deepwater Program Element concentrates on the following primary focus (2011 Annual Plan, September 2010, p. 11): “... *to fill-in identified technology and/or knowledge gaps related specifically to ultra-deepwater safety, environmental impact assessment, and environmental impact mitigation which are not currently addressed by the portfolio of projects and outstanding solicitations resulting from past Annual Plans*”. The proposed areas for investigation include the following (paraphrased):

1. Gather and analyze data, develop and test models to identify and quantify environmental and safety risks associated with all aspects of ultra-deepwater drilling.
2. Focus on overburden formations and reservoir characterization, evaluation and surveillance to minimize drilling, completion, and production risks.
3. Gather and analyze data, develop and test models with the objective of reducing environmental and safety risks while extending tieback distances and eliminating surface host installations.

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4. Improve environmental sustainability and safety of enhanced technology for direct intervention in wells in ultra-deep water.

5. Propose continuous improvement and innovation in the areas of environment and safety.

Subcommittee members are also cognizant of the following note from Secretary Chu appended to the statement of program areas (2011 Annual Plan, September 2010, p. 11): *"The Secretary is requesting recommendations from [Ultra-Deepwater Advisory Committee] UDAC on ways in which these or other R&D projects can assist in the identification of environmental and safety risks, and ways in which technology gaps can be identified and addressed."* Many of the same issues were raised by the Secretary during his visit to the UDAC meeting on 23 February 2011, and also appear in the Report to the President by the National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling ("Deepwater; the Gulf Oil Disaster and the Future of Offshore Drilling," January 2011) - hereafter referred to as the Deepwater Report.

In view of the extraordinary events of 2010, it is clear that the future R&D portfolio will have a major focus on health, safety, and environmental issues. This refocusing activity will be common to all of the agencies, governmental and other, that are associated with the offshore petroleum industry. However, the emphasis will vary from agency to agency. The Deepwater Report reached the conclusion that there is a distinction between ensuring the safety of personnel and the safety of the processes that are being operated (Deepwater Report, p. 218). This is not a new distinction; the Deepwater Report also states that the Safety Board's report on the Texas City refinery accident of 2005 (p. 221) makes the same point. It seems clear that the Portfolio Subcommittee should address issues in the area of process safety as a priority.

In addition to obtaining the best result with limited funds, the Subcommittee has taken the view that an ounce of prevention is worth a pound of cure. In principle, an accident can be prevented entirely, whereas once it has occurred, the impacts can only be limited. The ability to prevent or to control an accident is greatly dependent upon the quality and timeliness of the information available to the decision makers. In complex systems, the disparate experiences of individuals often provide inadequate guidance and frequently lead to dangerous analogies. Therefore, research topics are recommended that provide a knowledge base for designs and operations which are as failure-free as possible.

The members of the Portfolio Subcommittee have strong views on many organizational matters, including:

- How the industry might adopt a more proactive attitude towards health and safety,
- How accidents should be reported and managed, and
- The respective roles of government and industry in regulating offshore activities.

It is believed that the offshore industry may learn from other high-risk industries, such as the military (conventional and nuclear), aviation, and nuclear power generation.

The Subcommittee agrees with the Deepwater Report that accident investigation methods be conducted by an authority analogous to the airline industry's National Transportation Safety Board and suggested implementation of the "Safety Case" approach. These topics have been

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dealt with at great length in the Deepwater Report, notably in Chapter 8 “Safety is not proprietary” and Chapter 9 “Develop options...”

The Subcommittee agrees with a Safety Case approach rather than by prescriptive regulation. The essence of the Safety Case approach is that the onus is placed on industry to identify risks and to demonstrate their capabilities to manage those risks. It is noted that a potential problem with prescriptive regulation is that it generates a mindset that if all the prescriptions have been obeyed, then nothing can go wrong, and this leads to complacency. The Safety Case approach, being open-ended, tends to lead to a desirable attitude of chronic uneasiness (as described for the nuclear Navy, p. 230). There should be a continual sense of safety awareness. The majority of blowouts occur when wells are not being drilled. On the rig, there is a heightened awareness of safety while drilling but chronic uneasiness may tend to diminish when drilling is halted or the well is completed.

This sense of continual safety awareness should be maintained throughout the entire drilling and completion activities.

The Subcommittee offers the following suggestions:

Finding 1: Determining the risk of failure in ultra-deepwater

The probability of the *Deepwater Horizon* event occurring may have been reduced if more reliable information had been available from the well and the region of the wellhead prior to the incident. The process would have benefited from a more thorough understanding of potential risks. During drilling, important information would have included the reporting of pressures, fluid types, flow rates and temperatures as the flow of reservoir fluids was developing. Effective interpretation of this data, possibly by an automated system with appropriate alarms, might have emphasized the danger of the situation to rig personnel in sufficient time for them to have taken action to avoid a catastrophic event.

Recommendations

Recommendation 1A:

Conduct projects aimed at placing additional measuring instruments in the well and/or at the wellhead to determine the nature of the well fluids, pressures, and their flow status in real time. This work should be combined with developing secure methods for transmitting the data to surface and providing timely interpretation. Special emphasis should be placed on identifying and resolving ambiguous or single source measurements by providing multiple sources of information, and presentation of information in a manner more easily transmitted, understood, and interpreted.

Recommendation 1B:

To understand the probability of failure in ultra-deepwater conditions, develop a project to characterize the hazard-related risks associated with performance and testing requirements and prioritize the risks based on industry standards and best practice well procedures (i.e. including

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negative pressure and other integrity tests, cement design and placement and verifying the quality of the job by logging or pressure tests).

Recommendation 1C:

Develop an approach (i.e. expert “smart” systems that assimilate different data types) to assess the likely behavior of formations before drilling starts, with a view to integrating well design, drilling, and completion activities. This approach would take, for example, formation analysis, well planning, and activities during drilling and completion in order to identify and provide an early alert of potential hazards. This topic may also include the use of additional instrumentation to assess conditions ahead of the bit while drilling.

Recommendation 1D:

Conduct a study to understand the probability of failure modes of blow out preventers (BOPs) in UDW conditions (for example, high flow rates indicative of deepwater environments and pressures), based on industry standards and best-practice well procedures. From that identify tests, possibly to failure, for subsea equipment, including, among other things, BOP shear capability tests, time to actuate BOP rams and leakage tests. This activity may also include work to improve the design and monitoring of other subsea equipment, for example, riser shutdown valves and mooring system components.

Recommendation 1E:

Conduct a risk assessment from a regional perspective to understand consequences to the offshore industry of sudden catastrophic naturally occurring events (for example submarine landslides, earthquakes)

Finding 2: Controlling accident situations

Analysis of the incident indicated that from the initial blowout to the final capping of the well, control efforts were hampered by a lack of reliable information. This included difficulty in measuring flow from the well, knowing the status of the hardware (valve position) and measurement of pressures and other crucial data.

Recommendations

Recommendation 2A:

Support projects offering:

- Addition of and/or improvement to instrumentation at the wellhead (subsea and dry tree) and in the well to measure for example, temperatures and pressures, presence of hydrocarbons, BOP functions (valves or rams open or closed) accumulator pressure, and battery life and/or status.
- Interpretation capabilities (for example, expert systems) aimed at understanding well conditions related to potential hazards.
- BOP instrumentation that is replaceable by ROVs or AUVs supporting the entirety of well operations.

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Recommendation 2B:

Support the development of autonomous underwater vehicles (AUVs) that can independently access seafloor information and transmit it to surface uninterrupted (24/7) whether the original surface equipment is present or not. Such equipment may be combined with devices to:

- Detect hydrocarbon leaks from the sea floor and other subsea equipment (for example, pipelines, separation facilities).
- Investigate whether subsea acoustic measurements may be able to detect the magnitude and location of hydrocarbon flows from the wellhead and surrounding sea floor.

Recommendation 2C:

Support projects that evaluate and quantify limitations of equipment so that leaking equipment can be modified or repaired at the sea floor, and/or to allow collection facilities to be attached to seabed equipment in the event of a leak.

Finding 3: Collecting and dealing with spilled hydrocarbons

The *Deepwater Horizon* accident revealed that, although exceptional efforts were exerted during and after the event to collect, disperse or otherwise deal with spilled hydrocarbons, there was little in place before the accident occurred to deal with a spill. The Deepwater Report (p.135) mentions that “*In 1969, following the Santa Barbara Channel spill, the Nixon administration had issued a report recommending, in part, that 'underwater methods to collect oil from subsea leaks should be developed.' For deepwater wells, however, such development had never occurred.*”

Recommendations

Recommendation 3A:

Conduct studies of current subsea containment and capture technologies (hardware), including gap analyses and needs for future technologies with emphasis on subsea capture systems that are independent of surface facilities.

Recommendation 3B:

Develop a logic map (i.e., decision tree or flow chart) for determining adequate spill clean-up and collection methods for any given conditions, paying particular attention to the special conditions in deepwater (for example, risk of hydrate formation, weather conditions, underwater currents, water temperature and pressure, proximity to land).

Finding 4: Discovering attitudes towards safety issues in various peer groups

Because a number of behavioral factors associated with operations, maintenance, and training contributed to the incident, the Subcommittee finds that research aimed at discovering the fundamental attitudes of rig personnel and associated groups to health and safety issues. Discovering these attitudes is notoriously difficult, and may be critical to determine the

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acceptance of new safety regulations by the people affected. For example, one might ask how rig personnel react to being:

- Told to become “whistle-blowers”;
- Encouraged to suggest (or to implement) changes that improve safety while reducing the speed of activities; or
- Told to report co-workers who are seen to be “cutting corners”.

Recommendations

Recommendation 4A:

Conduct a study to evaluate potential applications of Expert Systems or other decision making procedures for:

- Well management,
- Accident detection, and
- Response based on best practice in other industries.

This study may include failure analysis (design, process and human) with a view to developing comprehensive risk assessment and reaction protocols, spanning a range of activities from reservoir management through well drilling, riser and vessel safety and station keeping with emphasis upon known approaches in operations research.

Comments: Several of the Subcommittee’s recommendations call for the measurement of more data in a variety of environments. As the amount of data increases there is an increased likelihood of human misinterpretation, confusion and error. Expert Systems can assist in the assimilation of the data and reduce human error.

Recommendation 4B:

Conduct a review of published and unpublished information available which analyzes the attitudes and knowledge of personnel and other peer groups toward health, environment, safety, and operational issues through the entire drilling and completion process to determine if training is effective, and if safety procedures are carried out conscientiously.

Finding 5: Considering project strategy

Although it is clear that the 2011 Annual Plan must have a major new emphasis towards health and safety issues, the Subcommittee finds that the current portfolio of ongoing projects is valuable and thus should continue.

Recommendation 5A:

Specifically, the graduate programs in technology should be broadened to include additional scientific disciplines.

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3.2 PROGRAM PROCESS FINDINGS AND RECOMMENDATIONS

Overview

The Subcommittee on Program Process is charged with examining and investigating the effectiveness and efficiency of the processes utilized by the program consortium in the solicitation, evaluation, selection and award of ultra-deepwater research and development projects pursuant to Subtitle J of EPLA 2005.

Specifically, the Subcommittee has been tasked with reporting to the Ultra-deepwater Advisory Committee (UDAC) the following matters:

- Scorecard(s) illustrating the process flow of research and development activities undertaken pursuant to the referenced subtitle;
- Identification of barriers and/or areas of improvement that would yield greater effectiveness and/or efficiencies of the program consortium;
- Recommendations of process improvements that would enhance the effectiveness and/or efficiency of the programs under the referenced subtitle;
- Benchmark comparisons with other research & development programs to address the perspective of relative program and/or program consortium performance; and
- Such other matters directed by the UDAC within the defined scope of this Subcommittee

It was decided that two of the Subcommittee's tasks; "*Scorecard illustrating the process flow of research and development activities undertaken pursuant to the referenced subtitle*" and "*Benchmark comparisons with other research and development programs.....*" were not to be addressed in this round of Subcommittee work. However, it was agreed that the Subcommittee would address "*Identification of barriers and/or areas of improvement that would yield greater effectiveness and/or efficiencies of the program consortium.*" and "*recommendations of process improvements...*". The Subcommittee concluded that the current program process and the directional change established by the 2011 Annual Plan of the Secretary of Energy would allow identification of findings and recommendations within the context of the existing program.

Therefore, the Subcommittee Chair Dr. Lesli J. Wood directed the Subcommittee to provide the following:

- Identification of barriers and/or areas of improvement that would yield greater effectiveness and/or efficiencies of the program consortium, and
- Recommendations of process improvements that would enhance the effectiveness and/or efficiency of the programs under the referenced subtitle.

The Subcommittee believes the existing program process is applicable for any directional changes the program may take as a result of the *Deepwater Horizon* incident. The Subcommittee provides the following findings and recommendations relative to the program process:

Finding 1: Concerning cycle time

While there have been significant improvements in the cycle time, which is defined as the time from approving the Annual Plan to the time when a contract has been awarded, the 2010 process is projected to take nearly 2 years. The long time involved in the process is a demotivating factor for groups coming forward with Research and Development (R&D) proposals and the different Technical Advisory Committees and Program Advisory Committee involved with respect to the RPSEA Program Consortium.

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Recommendations

Recommendation 1A:

Achieve the current goal of a 12 month cycle time from Annual Plan approval to project award. Examine the program process and address issues with respect to slippage and propose methods to attain and maintain the schedule.

Recommendation 1B:

Award 5-10 projects each year that are more focused. The Subcommittee recommends reviewing the program to ensure fewer and more focused R&D projects are in line with the 2011 Annual Plan.

Minority opinion: For an identified deepwater development research, award more monetarily smaller projects at the beginning to identify the appropriate technology and then follow up with larger size projects for further detailed investigation. This would help more industry participation and offer the opportunity to review and find the most appropriate solution for that technology need.

Finding 2: Concerning general solicitation

The current solicitation process is not reaching a broad enough audience to assure that the program addresses ways of capturing lessons learned and best practices, and preparing guidelines.

Recommendations

Recommendation 2A:

The solicitation process should be expanded to increase the engagement of other groups not being addressed in the current program. For example:

- Society of Petroleum Engineers, American Petroleum Institute, National Academies and other professional organizations,
- Regulatory forums, and
- Marine well containment companies.

Recommendation 2B:

Establish an Environmental and Safety Analysis Forum to broaden the solicitation audience towards the goal of capturing lessons learned and best practices, and preparing guidelines. Consider inviting organizations with experience in hazard identification and risk analysis.

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Finding 3: Concerning solicitation of environmental and safety issues

The current solicitation process is not reaching a broad enough audience to assure that the program addresses the development of an understanding of risk-based management and executive accountability for environmental and safety issues.

Recommendations

Recommendation 3A:

The solicitation process should be expanded to include:

- Risk management capability, and
- Environmental leadership and accountability management.

4.0 ULTRA-DEEPWATER ADVISORY COMMITTEE – 2011-2012

Dr. George A. Cooper* Professor University of California, Berkeley	Mr. Elmer P. Danenberger, III* Offshore Consultant	Mr. Daniel J. Daulton Director of Environmental Conformity and Marketing Baker Hughes Inc.
Dr. Quenton R. Dokken Executive Director Gulf of Mexico Foundation	Dr. Hartley H. Downs Technology Fellow Baker Hughes Inc.	Dr. Douglas J. Foster Senior Scientist ConocoPhillips
Mr. Lars Havardsholm Vice President, Field Development Statoil	Dr. Luc T. Ikelle* Robert R. Berg Professor Texas A&M University	Mr. James D. Litton* President and CEO Litton Consulting Group, Inc.
Mr. William C. New President and CEO New Industries, Inc.	Mr. D. Stephen Pye* Consultant	Dr. Nagan Srinivasan Executive Consultant Deepwater Structures, Inc.
Ms. Mary Jane Wilson President and CEO WZI, Inc.	Dr. Lesli J. Wood* Senior Research Scientist Bureau of Economic Geology University of Texas, Austin	

*Special Government Employee

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5.0 SUBCOMMITTEE TOPICS AND MEMBERS

The Plan review and preparation of the final Committee Report involved the following:

R&D Program Portfolio

Subcommittee Roster

- **Dr. George A. Cooper, Chair**
- **Mr. Elmer P. Danenberger, III**
- **Dr. Quenton R. Dokken**
- **Dr. Hartley H. Downs**
- **Dr. Douglas J. Foster**
- **Mr. James D. Litton**
- **Mr. William C. New**

Program Process

Subcommittee Roster

- **Dr. Lesli J. Wood, Chair**
- **Mr. Daniel J. Daulton**
- **Mr. Lars Håvardsholm**
- **Dr. Luc T. Ikelle**
- **Mr. D. Stephen Pye**
- **Dr. Nagan Srinivasan**
- **Ms. Mary Jane Wilson**

Editing

Subcommittee Roster

- **Mr. Daniel J. Daulton, Chair**
- **Dr. Hartley H. Downs**
- **Dr. Douglas J. Foster**
- **Ms. Mary Jane Wilson**