

## ***Methane Hydrate Advisory Committee (MHAC) Meeting***

**October 19, 2016**

**9:30 am – 4:45pm (EDT)**

**Washington, DC**

### **MEETING SUMMARY**

Attached are the meeting agenda and the list of attendees.

#### **DFO Welcome and Introductions, Neelesh Nerurkar, DFO**

The meeting was called to order at 9:30am EDT by Neelesh Nerurkar, Deputy Assistant Secretary (DAS) for Oil and Gas within the U.S. Department of Energy (DOE) and Designated Federal Officer (DFO) for the Methane Hydrate Advisory Committee (MHAC). All members introduced themselves and, as requested by DFO Nerurkar, briefly stated their area of interest with respect to gas hydrate research. In his introductory remarks DFO Nerurkar thanked the members for their public service and stated that the program is of great interest and importance to Secretary Moniz and to DOE. DFO Nerurkar briefly previewed the upcoming discussion of the Secretary's Energy Advisory Board (SEAB) Report on the Methane Hydrates Program. He thanked the members that participated in the peer review of the Technology Assessment for Gas Hydrates R&D which was a part of the 2015 Quadrennial Technology Review that was published in March of this year.

The goals of the Methane Hydrate Program were reviewed and the budget was briefly discussed. Sustained, multi-year funding is critical to address the key challenges in gas hydrate R&D. DFO Nerurkar noted that the SEAB Report will provide the support needed to allow DOE to make realistic, logical budget requests and receive those requested appropriations. Finally, DFO Nerurkar noted that a specific area of interest that he would like to hear input from the Committee was related to chemical stimulation and sequestration of CO<sub>2</sub> possibilities which could enhance the usefulness of gas hydrate research and resources.

After some brief discussion, DFO Nerurkar introduced Lou Capitanio to conduct committee business.

#### **Committee Business, Lou Capitanio, Committee Manager**

Lou Capitanio, the Committee Manager, outlined committee business. He reminded the group that all federal advisory committees are open to the public and deliberations must be done openly and transparently; minutes will be published in 2-3 weeks on the Committee website. He further informed the committee that no public comments were received in advance of the meeting nor has anyone requested to address the committee at the meeting. Mr. Capitanio thanked the members for their patience in completing the Human Resources documents required at the beginning of their appointments. He also announced that DOE's General Counsel's Office suggested that today would be a good time to conduct your annual ethics briefing for the 7 Special Government Employee (SGE) members present. The ethics briefings will be conducted during the lunch hour.

Finally, Mr. Capitanio advised the Committee of the need to elect a new Chairperson. The Chair runs the meetings, helps set the agenda, and approves meeting minutes. Mr. Capitanio asked for nominations. Both Dr. Carolyn Koh (Colorado School of Mines) and Dr. Miriam Kastner (University of California, San Diego) were nominated by the members. Following some discussion, a vote was taken and, by majority, Dr. Koh and Dr. Kastner were elected as Chair and Vice-Chair of the Committee, respectively.

#### **Presentation: Secretary of Energy Advisory Board Report on the Methane Hydrates Program – Mark Myers, Miriam Kastner, & Carolyn Koh, SEAB Task Force Members**

Committee members Mark Myers, Carolyn Koh, and Miriam Kastner, all members of the SEAB Task Force, delivered a presentation on the January 2016 SEAB Report on the DOE Methane Hydrates Program. Dr. Myers

led the presentation and reviewed the charge by Secretary Moniz to the SEAB. He reviewed the important questions developed by the SEAB Task Force, the answers to which framed the SEAB recommendations for the gas hydrate program. Dr. Myers et al provided insights into the SEAB Task Force discussions that took place; and then presented the six SEAB recommendations and the rationale that supported the recommendations.

Other highlights of the discussion included: 1) methane hydrates in the context of shale gas abundance; 2) significance of environmental research; 3) methane hydrates in the context of administration goals and budget; 4) paths forward in response to the SEAB recommendations to Secretary Moniz; 5) discussion of energy security and methane hydrates in an international context; 6) DOE's role and industry's involvement in near term vs. long research; 7) gas hydrate research in the face of a changing workforce, educational opportunities and student development; and 8) the benefits of establishing a relationship with the National Science Foundation (NSF); and 9) program stability and funding continuity.

It was suggested that DOE should investigate NSF participation in the next Committee meeting. Perhaps the NSF could provide an additional source of funding to gas hydrate research especially in relation to the carbon cycle and the environment since there is a lack of scientific consensus in this area. Dr. Kastner also recommended that the NSF's Division of Ocean Sciences (OCE) specifically may be a primary source of collaboration. Dr. Myers' presentation can be found on the Committee website at <http://energy.gov/fe/downloads/presentations-october-19-2016-advisory-committee-meeting>

### **Discussion: DOE Assessment of SEAB Report – Neelesh Nerurkar, DFO**

DFO Nerurkar noted that it was constructive to hear the discussions, consensus, and disagreements of the SEAB Task Force deliberations that the SEAB Task Force members presented. He further noted that the SEAB did highlight the importance of the Methane Hydrate Advisory Committee (MHAC) and the opportunity DOE has to research gas hydrates as a clean energy option while prudently dealing with emissions. The following general observations of the SEAB Report were noted by DFO Nerurkar:

- DOE concurs with SEAB's assessment of the program's outstanding contributions to the development of the current understanding of gas hydrates.
- DOE concurs with the SEAB report's emphasis on the need for the DOE to secure steady, more reliable funding in order to facilitate planning and program execution toward long-term strategic objectives.
- DOE concurs that gas hydrate is a potential option for enhancing the energy security of many key allies and, therefore, may be an important asset in global energy security.
- DOE concurs with the SEAB report's call to keep U.S. core capabilities relevant and to support other countries' efforts to develop their gas hydrates resources more effectively.
- DOE concurs with the SEAB report that the U.S. views its cooperation with foreign governments on international energy security as a high priority.
- DOE concurs that attempts to increase industry input in setting Program priorities should be pursued.
- DOE concurs with the SEAB report's confirmation for the need of a strong Federal role for gas hydrate research in the areas of resource evaluation, development of pre-commercial production approaches, and fundamental science related to properties of methane hydrate-bearing sediments and their behavior in the natural environment.
- DOE concurs with the SEAB report recommendation to continue efforts to assess gas hydrate's role in the natural environment, including potential feedbacks to climate change.
- DOE concurs with the SEAB conclusion that gas hydrate research investment is not in conflict with the long-term goals of lowering carbon emissions for climate mitigation; while the program, if successful, would enable the extraction of a new resource of fossil carbon, it would help to better quantify the potential environmental impact. Only a small fraction of all the

methane hydrate deposits could ever be commercially extractible, even at very high natural gas prices.

- DOE concurs with the SEAB analysis that the potential contribution of fossil carbon to the atmosphere through the commercial extraction of methane from hydrate reservoirs is relatively small compared to that of other fossil resources; and if extracted, natural gas is likely to replace future coal use, providing a net climate benefit.

The Program's initial implementation effort (which the Committee will hear more about in today's presentations) includes:

- An expansion in analytical studies in preparation for future field programs in partnership with the national programs of India, Korea, and Japan.
- A substantial increase to the allocation to the NETL in-house effort in fundamental science research for FY 2016.
- Issuance of a Funding Opportunity Announcement (FOA) this past summer that addressed the fundamental research contemplated by the task force recommendations.
- DOE is currently pursuing substantial leveraging of DOE funding in collaborative ventures with Japan (seeking field production experiments in Alaska), as well as India and Korea (seeking exploration, characterization, and field production experiments in the Indian Ocean and East Seas respectively); and will continue this effort with these and other nations as opportunities arise under the recommended budget levels

Discussion among the Committee hit upon many of the topics discussed following the Task Force member briefing on the SEAB Report recommendations. These topics included: 1) aligning MHAC meetings with budget cycle to improve information sharing; 2) pursuing a gas hydrate program in the context of a carbon cycle-specific program compared to a resource exploitation program; 3) reengaging with domestic partners like NSF; 4) engaging with international partners to improve domestic energy security through leveraged research; 5) recognition of industry's role and enhance Committee through greater industry involvement; 6) improve academic participation through increase Fellowship appointments; 7) the value of field testing compared to fundamental science research and continuity of each in the face of funding challenges; and 8) the unique challenges of short-term research compared to long-term research.

### **Presentation: Methane Hydrate Research Program – Jared Ciferno, NETL**

Jared Ciferno, NETL Oil and Gas Technology Manager, presented an overview of the Methane Hydrate Research Program which focused on stakeholder engagement to leverage opportunities for research; research objectives, approach, and milestones; budget review and major Program accomplishments; and Program goals and key activities. Mr. Ciferno stressed the importance of aligning SEAB recommendations, the MHAC, and NETL implementation of the program to provide better technical research collaboration and to overcome technical barriers. He noted that program planning could be developed in consultation with the MHAC as the SEAB Report recommended. Finally, he discussed risks involved and their mitigation.

Mr. Ciferno then presented an overview of the six gas hydrate projects that were recently selected from proposals received in response to DOE's FY 2016 Funding Opportunity Announcement. Three projects were selected in each of two topic areas – methane hydrate system response to induced change and methane hydrate system response to natural environmental change. He presented project descriptions and costs. Both of Mr. Ciferno's presentations can be found on the Committee website at

<http://energy.gov/fe/downloads/presentations-october-19-2016-advisory-committee-meeting>

### **DFO Summary and Guidance, Neelesh Nerurkar, DFO**

Just prior to the lunch break, DFO Neelesh Nerurkar thanked the Committee for their participation and challenged them to consider three points during the afternoon discussion: 1) the potential for CO<sub>2</sub> exchange

with respect to the production methane and the storage of CO<sub>2</sub>; 2) getting the MHAC back together in the Spring (May 2017) with the meeting focus being on the knowledge gaps in data due to changing environments; and 3) setting relative priorities for the gas hydrate program that should be represented moving forward in DOE's research.

Finally, DFO Nerurkar advised the Committee that he would not be able to be present for the afternoon session of the meeting and that Guido DeHoratiis has been designated as the acting DFO for that portion of the meeting.

### **Presentation: DOE's Gas Hydrates Major Project Review – Ray Boswell, NETL**

Dr. Ray Boswell presented a review of DOE's two major field programs – the Alaska North Slope (ANS) field testing and the Gulf of Mexico (GOM) exploration and characterization projects. The ANS field testing began with a brief description of prior Alaska field programs – Hot Ice (2004), Mt. Elbert (2007), and Ignik Sikumi (2011-2012). Dr. Boswell then reviewed the types of gas hydrate production technology - thermal, chemical, mining, and depressurization – and reviewed challenges associated with gas hydrate production. In regards to production technology, Dr. Boswell noted that, to date only short-duration scientific field experiments have been done.

Dr. Boswell then made the case that a long-term depressurization test is the next priority in gas hydrate production research and presented DOE's recent, and ongoing, efforts to conduct such a test. He noted that Japan (JOGMEC) is DOE's partner in this effort and that the USGS and Alaska Department of Natural Resources have been key participants and contributors. Dr. Boswell stated that a location in the westend of the Prudhoe Bay Unit (PBU) has been identified as the most favorable for the long-term test. A draft well plan has been prepared and the project partners are now seeking approval of the PBU working interest owners for access to the desired location within the PBU. Dr. Boswell then presented the plan forward for the test, beginning with drilling a stratigraphic test well to confirm the gas hydrate resource at the PBU location.

Dr. Boswell reviewed the prior GOM major field projects and the evolution in marine gas hydrate exploration. The current GOM resource characterization project is being led by the University of Texas at Austin. Two expeditions are planned. Expedition 1 (2017) is a single site, two-hole program with pressure cores being collected, transferred and analyzed. Expedition 2 (2019/2020), also for the purpose of marine gas hydrate characterization, will include logging and pressure coring at multiple sites in the GOM. He described the pressuring coring and core transfer tools that will be utilized in the expeditions. Finally, Dr. Boswell discussed the next steps to conduct the planned field expeditions. Dr. Boswell's presentation can be found on the Committee website at <http://energy.gov/fe/downloads/presentations-october-19-2016-advisory-committee-meeting>

### **Presentation: NETL In-House Gas Hydrate Research – Yongkoo Seol, NETL**

Dr. Yongkoo Seol provided a briefing on the NETL in-house research activities that is being conducted through its Research and Innovation Center (R&IC). Dr. Seol noted that the in-house work supports the mission of the Methane Hydrate Program of realizing the resource potential of gas hydrates through: improved understanding of the fundamental behavior of hydrates, both *in situ*, and during man-made disturbances; the development of predictive models that accurately describe gas production, responsive ground deformation, and environmental impacts; and laboratory experiments that support numerical simulations by providing accurate input data.

Dr. Seol discussed the importance, scope, and accomplishments for five areas that the in-house research is addressing. These areas are: numerical simulation support, thermal-hydro-chemo-mechanical simulation, fundamental property characterization, field support and external collaboration, and systems engineering and analysis. Of particular note was a discussion of natural versus synthetic hydrates, the limitations of usage of synthetic hydrates for hydrate characterization, and the readiness of R&IC to accept the natural pressure cores for laboratory analyses. Dr. Seol's presentation can be found on the Committee website at <http://energy.gov/fe/downloads/presentations-october-19-2016-advisory-committee-meeting>

## **Presentation: Gas Hydrates and the Environment – Ray Boswell, NETL**

Dr. Ray Boswell's presentation explored the relevance of methane from gas hydrates to climate and the ocean-atmospheric system. Of particular note was the discussion that not all gas hydrate is directly coupled to the ocean-atmospheric system. A significant general observation was that the current gas hydrate resource recovery target is a completely different subset of total gas hydrate resources than is the climate-sensitive gas hydrate resources; and that these two subsets should not be discussed as impacting one another.

Dr. Boswell noted that ongoing projects are accessing large external resources to assess gas hydrate dynamics in climate-sensitive areas and described the activities in the North Atlantic/Svalbard Margin, Cascadia Margin, Atlantic Margin/U.S. East Coast, and the Beaufort Shelf. Dr. Boswell's presentation is included within the major project presentation slides that can be found at <http://energy.gov/fe/downloads/presentations-october-19-2016-advisory-committee-meeting>

## **Presentation: International Gas Hydrate Research – Tim Collett, U.S. Geological Survey**

Dr. Tim Collett of the USGS presented an update on international gas hydrate research activities. The update provided an overview of international gas hydrate scientific research, drilling activities, and gas hydrate production testing in both deepwater and permafrost environments. Specific focus was given to two highly visible international gas hydrate field programs currently in progress: Japan's drilling and testing in the Nankai Trough and India's NGHP-02 and NGHP-03 expeditions in the Indian Ocean. In addition to these international programs, Dr. Collett provided a brief overview of other international gas hydrate R&D activities being conducted worldwide, including the programs of China, South Korea, Norway, Canada, New Zealand, the European Union, and others. He also noted that there remains strong international interest in an extended duration test on the Alaska North Slope.

In his summary of international gas hydrate R&D opportunities, Dr. Collett noted that:

- Testing to constrain potential production rates are required. A variety of tests are needed studying different geologic conditions.
- "Scientific" tests designed to maximize scientific insight should be completed initially followed by "production" tests designed to maximize rates.
- Testing needs to include advance monitor programs to identify and assess environmental response/impacts.
- DOE, JOGMEC, and USGS are developing plans for an extended hydrate production test pilot in Alaska.
- JOGMEC is planning a gas hydrate production test in Nankai Trough in 2016/2017.
- India is planning for gas hydrate production test in KG Basin 2017/2018.
- China-GMGS is considering plans for a 2017 gas hydrate production test in the South China Sea.

Dr. Collett's presentation can be found on the Committee website at

<http://energy.gov/fe/downloads/presentations-october-19-2016-advisory-committee-meeting>

## **Committee Discussion**

Dr. Carolyn Koh, newly elected Chair of the Committee led the discussion. The discussion focused on the three points that DFO Neelesh Nerurkar suggested.

The Committee first addressed CO<sub>2</sub> exchange (a theoretical chemical production process whereby CO<sub>2</sub> injection into gas hydrate deposits could be designed to produce a relatively rapid and efficient molecular substitution to achieve the permanent storage of CO<sub>2</sub> in hydrate form in exchange for the simultaneous release of methane). While there was a general consensus that this was an interesting science question to investigate, there was much discussion of the challenges of this process. Practicality is a major concern of the Committee members –

cannot get enough CO<sub>2</sub> into storage to make an impact; most hydrate deposits are below 500 meters of water and not near any CO<sub>2</sub> sources; who would be able to utilize this process.

It was suggested that perhaps there is something that just has not been thought of in placing CO<sub>2</sub> and other chemicals in a gas hydrate deposit. Perhaps a fundamental study is needed to further study the exchange at the molecular level. The Committee concluded that at this time pursuing CO<sub>2</sub> exchange should not be a high priority of the Gas Hydrate Program. While chemical injection will likely serve a complementary role in ultimate integrated production systems in certain settings, DOE's immediate focus should be on depressurization as the highest priority for future gas hydrate production R&D such as is being planned for the Alaska production test.

There also was discussion of production footprints for methane hydrates and how they compare to conventional gas or other fuels. The Committee explored potential burdens associated with developing methane hydrates and what percentage of leakage negates the benefits of that fuel source (compared to conventional sources). The review of energy source tradeoffs has not been a MHAC role/area in the past and the group suggested considering the topic area for future discussion, with specific focus need for life cycle analysis of gas hydrate development.

Finally, there was some discussion on whether gas hydrate production will be different or similar to traditional natural gas production in terms of methane emissions. There was a general agreement that further consideration of any unique potential for the leakage of methane from gas hydrate production may be needed.

Regarding the next meeting of the Committee, Dr. Koh and Vice-Chair Miriam Kastner suggested a teleconference be held in February 2017. During that meeting the Committee could discuss the agenda items for an in-person meeting to be held in the May/June 2017 timeframe. Dr. Kastner recommended that the meeting be planned for 1½ days to accommodate thorough discussion. Dr. Koh further suggested that the meeting be held in Denver adjacent (in time) to the International Conference on Gas Hydrates scheduled for June 25-30, 2017. The Committee members were in general agreement with the timing, location, and length of this in-person meeting. Acting DFO Guido DeHoratiis noted that the timing of such a meeting is a little late in the budget formulation process but may allow the Committee to provide input into the DOE's FY 2019 budget request.

The meeting adjourned at 4:30pm EDT.



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Carolyn Koh, Chair



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Neelesh Nerurkar, DFO

**Table 1: List of Attendees**

Attendee	Role
Dr. Thomas Blasingame Texas A&M University Department of Petroleum Engineering	Committee Member
Mr. Richard Charter Senior Fellow The Ocean Foundation	Committee Member
Dr. Miriam Kastner Scripps Institute of Oceanography University of California, San Diego	Committee Vice-Chair
Dr. Carolyn Koh Colorado School of Mines Chemical Engineering Department	Committee Chair
Dr. Michael Max Chief of Research Hydrate Energy International, Inc.	Committee Member
Dr. Joel E. Johnson University of New Hampshire Department of Earth Sciences	Committee Member
Dr. Robert L. Kleinberg Schlumberger Fellow Schlumberger-Doll Research	Committee Member
Dr. Craig Shipp Geohazards Assessment and Pore Pressure Prediction Team Shell International Exploration and Production Inc.	Committee Member
Dr. Robert D. Kaminsky Emerging Resources Advisor ExxonMobil Upstream Research Co.	Committee Member
Dr. George J. Moridis Head, Hydrocarbon Resources Program Lawrence Berkeley National Lab University of California	Committee Member
Dr. Mark D. Myers Commissioner, Alaska Department of Natural Resources – retired	Committee Member
Dr. Matthew J. Hornbach Southern Methodist University Huffington Department of Earth Sciences	Committee Member

Neelesh Nerurkar Deputy Assistant Secretary for Oil and Gas U.S. Department of Energy	DFO
Guido DeHoratiis Associate Deputy Assistant Secretary for Oil and Gas U.S. Department of Energy	DOE Staff
Lou Capitanio Committee Manager U.S. Department of Energy	DOE Staff
Evan Frye U.S. Department of Energy	DOE Staff
Doreen Nevin MIRACORP	DOE Support
Jared Ciferno National Energy Technology Laboratory Pittsburgh, PA	Speaker
Ray Boswell National Energy Technology Laboratory Pittsburgh, PA	Speaker
Rick Baker National Energy Technology Laboratory Morgantown, WV	Other
Yongkoo Seol National Energy Technology Laboratory Morgantown, WV	Speaker
Tim Collett USGS Denver, CO	Speaker
Warren Wood Naval Research Laboratory	Other

## ***Methane Hydrate Advisory Committee Meeting***

**October 19, 2016 9:30am – 4:45pm (EDT)**

### **Public Access**

U.S. Department of Energy  
Forrestal Building, Room 3F-071  
1000 Independence Ave., SW  
Washington, DC 20585

### **AGENDA**

**October 19, 2016 9:30am – 4:45pm (EDT)**

Time	Discussion Item	Speaker	
8:45 am – 9:30 am	Registration <ul style="list-style-type: none"><li>Member Appointment Documents Collected</li><li>Special Government Employees Sworn-In</li></ul>	DOE Human Resources Representative	All
9:30 am – 9:40 am	DFO Welcome and Introductions	Neelesh Nerurkar, DAS for Oil and Natural Gas, and Designated Federal Officer (DFO)	
9:40 am – 9:50 am	Committee Business <ul style="list-style-type: none"><li>Election of Committee Chair</li></ul>	Lou Capitanio, Committee Manager, and Methane Hydrate Program Manager	
9:50 am – 10:20 am	Secretary of Energy Advisory Board (SEAB) Report on Methane Hydrates Program	Mark Myers, Miriam Kastner, and Carolyn Koh, SEAB Task Force Members	
10:20 am – 10:50 am	DOE Assessment of SEAB Report <ul style="list-style-type: none"><li>Implementation of Recommendations</li><li>Program goals and strategy</li><li>Role of the Advisory Committee</li></ul>	Neelesh Nerurkar, DAS for Oil and Natural Gas, and Designated Federal Officer (DFO)	
10:50 am – 11:00 am	Break		All
11:00 am – 11:30 am	Gas Hydrate Program including FY16 Program Review, FY17 Operating Plans, NETL Reorganization, Program Budget	Jared Ciferno National Energy Technology Laboratory (NETL)	

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11:30 am – 11:45 am	FY16 Funding Opportunity Announcement Awards	Rick Baker National Energy Technology Laboratory (NETL)
11:45 am – 12:25 pm	Major Project Review <ul style="list-style-type: none"> <li>• Gulf of Mexico Project Update</li> <li>• Alaska Project Update</li> </ul>	Ray Boswell National Energy Technology Laboratory (NETL)
12:25 pm – 1:15 pm	Lunch	All
1:15 pm – 1:35 pm	NETL In-House Work Plans	Yongkoo Seol National Energy Technology Laboratory (NETL)
1:35 pm – 2:05 pm	Update on International Activities	Tim Collett, U. S. Geological Survey, Denver, CO
2:05 pm – 2:25 pm	Gas Hydrates and the Environment	Ray Boswell, National Energy Technology Laboratory (NETL)
2:25 pm – 2:35 pm	Break	All
2:35 pm – 4:30 pm	Committee Discussion	Chairman Methane Hydrate Advisory Committee
4:30 pm – 4:45 pm	Public comments, if any	Neelesh Nerurkar, DAS for Oil and Natural Gas, and Designated Federal Officer (DFO)
4:45pm	Adjourn	

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/s/ Neelesh Nerurkar  
APPROVED: Neelesh Nerurkar  
Designated Federal Official

9/15/16  
Date