Oil & Natural Gas Technology

DOE Award Number: DE-FE0022898

Research Performance Progress Report (Period Ending 9/30/2015)

Alaska Natural Gas Hydrate Production Testing, Test Site Selection, Characterization and Testing Operations

Project Period (09/01/2014 – 12/31/2015)

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ABSTRACT

Alaska Natural Gas Hydrate Production Testing, Test Site Selection, Characterization and Testing Operations

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The objective of this Department of Energy (DOE)-United States Geological Survey (USGS) Interagency Agreement is to provide geologic and geophysical technical support to identify and characterize gas hydrate production test sites on the Alaska North Slope as specified in the goals of the 2005 Energy Act for National Methane Hydrates R&D, the DOE-led US Interagency Roadmap for Gas Hydrate Research, and elements of the USGS mission related to energy resources.

This effort is addressing critical issues associated with production of gas hydrates, and is contributing to our understanding of the geologic nature of the gas hydrate accumulations, the geophysical characteristics of in-situ natural gas hydrates, and helping develop plans for an extended gas hydrate production testing program in northern Alaska. This project is designed as a cooperative research effort, with USGS providing technical geoscience support in a partnership that has included so far the DOE, the Alaska Department of Natural Resources, the Japan Oil Gas and Metals National Corporation (JOGMEC), and Petrotechnical Resources Alaska.

During this reporting period (1/1/2015 - 9/30/2015), the USGS, DOE, and JOGMEC worked together to identify and refine our understanding of the potential gas hydrate prospects on the withheld State of Alaska managed leases located to the east of the Milne Point Unit in northern Alaska. The scope of this effort was expanded during this reporting period and two additional high priority potential gas hydrate test sites were identified and forwarded for consideration of testing, which included the Milne Point Unit Cascade site (MPU K-Pad) and Prudhoe Bay Unit Kuparuk 7-11-12 site.

Within this project, the remapping the Eileen gas hydrate trend in the greater Prudhoe Bay area has provided critical new insight into the occurrence of gas hydrate on the Alaska North Slope and detailed understanding of the reservoir parameters needed to understand the production response of the gas hydrates. The FY-2015 DOE/USGS funded efforts have provided a significantly refined understanding of the geologic nature of the Eileen gas hydrate trend.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Project Scope and Accomplishments

Work conducted under this Interagency Agreement is intended to provide support to the DOE and its research partners in understanding, predicting, and testing the recoverability and potential production characteristics of onshore natural gas hydrate in the Greater Prudhoe Bay area on the Alaska North Slope or other areas deemed suitable, through mutual agreement of DOE and USGS, for potential long term production testing of gas hydrate. To do so, this project is designed to evaluate the occurrence and resource potential of the known gas hydrate accumulations in the Eileen trend. This project consists of one task that includes two subtasks. The first subtask involves the geologic and engineering assessment of the Eileen gas hydrate accumulation. The second subtask supports DOE and their industry partners with evaluation, planning and preparations for drilling and testing of gas hydrate research wells in northern Alaska.

In general, the goals of this task remained the same over this reporting period, with the USGS leading the geoscience aspects of the DOE sponsored effort to conduct an extended gas hydrate production test on the Alaska North Slope, focusing on a series of new gas hydrate prospects on lands managed by the State of Alaska (SOA) located to the east of the Milne Point Unit. During this reporting period the USGS also acquired the responsibility to identify additional sites for potential gas hydrate production testing in the unitized lands overlying the Prudhoe Bay (PBU) and Milne Point (MPU) oil fields. During this reporting period the USGS also acquired access to critical industry 3D seismic data volumes that extend onto the SOA lands along the eastern edge of the MPU.

This new expanded test site effort has yielded two new data/knowledge streams, including the (1) remapping and detailed reservoir characterization of the Eileen gas hydrate trend in the PBU-MPU and (2) the identification and detailed characterization of gas hydrate prospects on the SOA lands (also known as North Shore area) east of the MPU. The geologic data obtained from the Mount Elbert and Iḡnik Sikumi test well projects in PBU-MPU have yielded one of the best delineated and described gas hydrate accumulations in the world. The new effort supported by this award have provided a significantly refined understanding of the geologic nature of the Eileen gas hydrate trend with a focus on the gas hydrate accumulation in and around the Prudhoe Bay Unit L-Pad, which is located near the site of the Iḡnik Sikumi test well as drilled and tested in FY-2013. This effort has resulted in the generation of a draft report that describes the methodology and results used in series of closely related geologic studies to characterize the occurrence of gas hydrate in the area of the of the PBU L-Pad area and throughout the Eileen trend. This report further reviews and integrates into one comprehensive petroleum system model the results and geologic related findings associated with the Mount Elbert and Iḡnik Sikumi test well projects. This study also included the integrated analysis of well log data from more than 70 wells from across the Eileen trend to yield the most detailed reservoir model for any known gas hydrate accumulation in the world.

The SOA lands test site gas hydrate prospecting effort has gained momentum with the addition of a new project partner enabled through a DOE-MOU: the Japan Oil, Gas and Metals National Corporation (JOGMEC). Under this MOU, the USGS is working with JOGMEC and DOE on the gas hydrate prospecting effort on the SOA land that was set aside for gas hydrate research. The USGS and JOGMEC are working closely together on the technical aspect of this project. One of the USGS contributions to this effort has been the completion of a series of seismic

inversions of 8 new gas hydrate prospects that have yielded 3D analysis of gas hydrate reservoir thicknesses and predicted gas–hydrate reservoir saturations.

Formal planning for the next gas hydrate production-related testing project in northern Alaska has continued, with the USGS providing guidance and technical support to the DOE, JOGMEC, and Petrotechnical Resources Alaska. During this reporting period, the USGS hosted two test site review meetings in Denver, Colorado that was attended by JOGMEC and DOE geoscience technical staff. The USGS also participated in a series of project planning and technical review meetings in Anchorage, Alaska and Chiba, Japan. The USGS also hosted a series of monthly web style meetings in support of this effort. The USGS is also working with JOGMEC and DOE to develop technical support contracts with service providers in Alaska. It is envisioned that theses service contracts will provide the technical support for the (1) stratigraphic test drilling and (2) multi-year production test phases of this project.

Project Meetings, Outreach, and Presentations (for the period 1/1/2015 - 9/30/2015)

January 7, 2015: Hosted an Alaska North Slope gas hydrate test site review meeting (web meeting).

January 27, 2015: Hosted an Alaska North Slope gas hydrate test site review meeting (web meeting).

February 17, 2015: Hosted an Alaska North Slope gas hydrate test site review meeting (web meeting).

March 9-10, 2015: Participated in a technical review workshop in Austin, Texas organized by the University of Texas to review the develop and status of the DOE developed Hybrid Pressure Core System and associated laboratory equipment.

March 11-13, 2015: Hosted a technical site review meeting in Denver, Colorado with members of the JOGMEC and DOE gas hydrate project geoscience teams in support of the Alaska North Slope cooperative gas hydrate test site review project.

April 15-17, 2015: Participated in a series of technical site review meetings in Chiba, Japan with members of the JOGMEC and DOE gas hydrate project geoscience teams in support of the Alaska North Slope cooperative gas hydrate test site review project.

May 19, 2015: Hosted an Alaska North Slope gas hydrate test site review meeting (web meeting).

June 11, 2015: Hosted an Alaska North Slope gas hydrate test site review meeting (web meeting).

June 30, 2015: Hosted an Alaska North Slope gas hydrate test site review meeting (web meeting).

July 14, 2015: Hosted an Alaska North Slope gas hydrate test site review meeting (web meeting).

July 28-31, 2015: Participated in a series of technical site review meetings Anchorage, Alaska with members of the JOGMEC and DOE gas hydrate project geoscience teams in support of the Alaska North Slope cooperative gas hydrate test site review project.

August 12-14, 2015: Member of US-DOE delegation to Mexico City (Mexico) for high level meetings with the Secretaria de Energia de Mexico with the goal to review and develop cooperative gas hydrate research opportunities in the Gulf of Mexico.

August 19, 2015: Hosted an Alaska North Slope gas hydrate test site review meeting (web meeting).

September 1, 2015: Participated in a DOE / University of Texas Hybrid Pressure Core System operational review meeting (web meeting) and provided technical briefing on recent field related system deployments.

September 2, 2015: Hosted an Alaska North Slope gas hydrate test site review meeting (web meeting).

September 16, 2015: Provided expert testimony on goals and structure of modern gas hydrate scientific drilling expeditions for the Secretary of Department of Energy Advisory Board (meeting held in DOE Headquarters in Washington DC).

September 23, 2015: Hosted an Alaska North Slope gas hydrate test site review meeting (web meeting).

September 28-30, 2015: Chaired a session on gas hydrates in the Circum-Arctic at “The Arctic Polar Petroleum Potential Conference” in Stavanger, Norway. Also a member of the Conference Technical Committee and presented a key-note technical review of Arctic gas hydrate production tests.

Publications

Boswell, R., Saeki, T., Shipp, C., Frye, M., Shedd, B., Collett, T.S., Shelander, D., and McConnell, D., 2014, Prospecting for gas hydrate resources: DOE-NETL Fire in the Ice Newsletter, v. 14, Issue 2, 4 p.

Boswell, R., Yamamoto, K., Lee, S.R., Collett, T.S., Kumar, P., and Dallimore, S., 2014, Methane hydrates, in T.M. Letcher ed., Future of Energy - Improved, Sustainable and Clean Options for our Planet, Second Edition, Elsevier B.V. Publishing, p. 159-178. http://www.sciencedirect.com/science/article/pii/B9780080994246000089

Collett, T.S., 2014, Arctic Gas Hydrate Research Accomplishments, in Proceedings of the Canada - United States Northern Oil and Gas Research Forum, Yellowknife, Northwest Territories, Canada, November 4-6, 2014, 10 p.

Collett, T., Bahk, J-J., Baker, R., Boswell, R., Divins, D., Frye, M., Goldberg, D., Husebo, J., Koh, C., Malone, M., Morell, M., Myers, G., Shipp, C., and Torres, M., 2015, Methane hydrates in nature – current knowledge and challenges: Journal Chemical Engineering Data, v. 60, no. 2, p. 319-329.

Collett, T.S., Boswell, R., Cochran, J.R., Kumar, P., Lall, M., Mazumdar, A., Ramana, M.V., Ramprasad, T., Riedel, M., Sain, K., Sathe, A.V., Vishwanath, K., the NGHP Expedition 01 Scientific Party, 2014, Geologic implications of gas hydrates in the offshore of India: results of the National Gas Hydrate Program Expedition 01: Journal of Marine and Petroleum Geology, v. 58, p. 3-28 (DOE funds were not used to support this publication, included for informational purposes).

Kumar, P., Collett, T.S., Boswell, R., Cochran, J.R., Lall, M., Mazumdar, A., Ramana, M.V., Ramprasad, T., Riedel, M., Sain, K., Sathe, A.V., Vishwanath, K., the NGHP Expedition 01 Scientific Party, 2014, Geologic implications of gas hydrates in the offshore of India: Krishna-Godavari Basin, Mahanadi Basin, Andaman Sea, Kerala-Konkan Basin: Journal of Marine and Petroleum Geology, v. 58, p. 29-98 (DOE funds were not used to support this publication, included for informational purposes).

Wang, X., Collett, T.S., Lee, M.W., Yang, S., Guo, Y., and Wu, S., 2014, Geological controls on the occurrence of gas hydrate from core, downhole log, and seismic data in the Shenhu area, South China Sea: Journal of Marine Geology, v. 357, p. 272-292 (DOE funds were not used to support this publication, included for informational purposes).

Boswell, R., Shipp, C., Reichel, T., Shelander, D., Saeki, T., Frye, M., Shedd, W., Collett, T., and McConnell, D., (in press), Prospecting for Marine Gas Hydrate Resource: Interpretation Journal.

Collett, T., Riedel, M., Cochran, J., Boswell, R., Presley, J., Kumar, P., Sathe, A., Sethi, A., and Lall, M., 2015, Indian National Gas Hydrate Program Expedition 01 Report. USGS Scientific Investigations Report 2012-5054, p. 1-1,442 (DOE funds were not used to support this publication, included for informational purposes).

Wang, X., Collett, T., Shi, H., Yang, S., Wang, Z., Chen, D., Li, Y., and Yan, C., (in press), Characterization of gas hydrate distribution using conventional three-dimensional seismic data in the Pearl River Mouth Basin, South China Sea: Interpretation Journal (DOE funds were not used to support this publication, included for informational purposes).

Zyrianova, M.V., and Collett, T.S., (in review), Well log characterization and of natural gas hydrate accumulations in the Eileen Trend, Alaska North Slope: Journal Energy & Environmental Science.

Project Near-Term Work Plan

Over the next project reporting period, the USGS will continue to contribute to the planning effort in support of the DOE-JOGMEC-USGS sponsored gas hydrate production test well program on the Alaska North Slope, focusing on further characterizing a series of gas hydrate prospects on State of Alaska withheld lands located to the east of the Milne Point Unit and in the unitized lands of both the Milne Point and Prudhoe Bay units. The USGS will also provide technical and scientific leadership and advice for formulation of research drilling and production testing program designed to assess the nature and production potential of methane hydrates on the Alaska North Slope.

USGS and State of Alaska Department of Natural Resources (SOA-DNR) technical staff are also scheduled to convene an internal workshop to identifying potential gas hydrate production

test sites in the PBU and the MPU. This new cooperative effort with SOA-DNR geologists will include the use confidential seismic data that will be strictly controlled by confidentiality agreements.

COST STATUS

The total funds spent from this account during the period from 10/1/2014 through 9/30/2015) are summarized below along with the current project account balance.

Total DOE Award	$	51,608.00
USGS Overhead	$	(11,094.00)
Expenses 10/1/2014 through 9/30/2015	$	(23,927.00)
Project Account Balance	$	16,587.00

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