

Oil & Natural Gas Technology

DOE Award Number: DE-FE0022898

Research Performance Progress Report (Period Ending 3/31/2016)

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

Project Period (09/01/2014 – 12/31/2016)

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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 (PRA).

During this reporting period (9/30/2015 - 4/1/2016), 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. Over this reporting period, however, most of our test site review effort was refocused to assess the gas hydrate prospects in the Westend of the Prudhoe Bay Unit (PBU). The remapping of the Eileen gas hydrate trend in the greater Prudhoe Bay area has conclusively determined that the one location that combines known gas hydrate occurrences with existing infrastructure with no ongoing industry activities is the gravel pad at the site of the Kuparuk 7-11-12 exploration well, within the Westend of the PBU.

The gas hydrate well test design efforts have continued and it has been proposed that the test program will include the drilling and evaluation of a stratigraphic test well, followed by the establishment of a production test site (including surface monitoring, instrumented monitoring wells, and a production well), and then the testing of reservoir response to pressure reduction over a period of from 12 to 24 months.

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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. We have continued to contribute to the DOE- and industry-sponsored cooperative gas hydrate projects in northern Alaska. The USGS in cooperation with the Japan Oil, Gas and Metals National Corporation (JOGMEC) and the DOE have further characterized 12 new gas hydrate prospects on the withheld State of Alaska (SOA) lands east of the Milne Point Unit. The USGS has also worked with SOA Department of Natural Resources and BPXA to identify and characterize the PBU Kuparuk 7-11-12 prospect in the Prudhoe Bay Unit, which elevated this prospect as the lead site for the proposed Alaska North Slope gas hydrate production test pilot. A consortium led by DOE, JOGMEC, and the USGS are currently working with Prudhoe Bay Working Interest Owners (which include BPXA, ConocoPhillips, and Exxon) to identify an operator for the proposed gas hydrate production test pilot on behalf of the government-industry led effort. The USGS will continue to lead the G&G effort in support of the test site selection and characterization efforts.

The current plan under consideration for the pilot production test includes the drilling of a stratigraphic test well at the PBU Kuparuk 7-11-12 prospect in early 2017 followed by a multi-year production test likely commencing in 2018. The field program as currently conceived would consist of four primary phases. In Phase 1, a stratigraphic test well will be drilled and logged to confirm reservoir occurrence and condition. Assuming confirmation of viable reservoirs, the proponents would wish to proceed into a second Phase 2 to accomplish the establishment of the test site, including the installation of surface air and subsidence monitoring equipment, drilling of one or more monitoring wells including a full scientific logging, borehole geophysics, and coring program, and drilling and completion of a production test well. In Phase 3, the test well will be produced through a series of reservoir depressurization tests utilizing downhole pumps. Gas and water production rates will be closely monitored and samples collected. All samples will be analyzed in offsite labs. The tests will proceed for sufficient time (up to two years) such that reservoir deliverability can be confidently determined. In addition, a series of interventions and stimulations may be deployed as warranted, depending on the nature of the reservoir response. Should the well behave exceptionally well, planned events may be implemented to test approaches for maintaining and re-starting gas hydrate wells during well shut-ins and other mechanical disruptions. In Phase 4, the site will be abandoned per PBU protocols.

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 a test site review and production well test design meeting in Denver, Colorado that was attended by JOGMEC and DOE geoscience technical staff. During this reporting period, the USGS also participated in two technical site review workshops with the State of Alaska Department of Natural Resources geoscience team in support of the Alaska North Slope cooperative gas hydrate test site review effort. The USGS also contributed to a series of monthly web style meetings in support of this effort.

Project Meetings, Outreach, and Presentations (for the period 9/30/2015 - 3/31/2016)

September 28 – October 2, 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 (Stavanger, Norway).

October 5-7, 2015: The USGS sent a representative (T.S. Collett) to the COST funded European Union gas hydrate MIGRATE kickoff meeting in Malaga, Spain. MIGRATE is a networking project for EU scientists focused on gas hydrate energy development. Collett gave a keynote addressed that reviewed the accomplishments of US-DOE sponsored gas hydrate R&D efforts in the US (Malaga, Spain).

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

October 19-23, 2015: USGS staff participated in a technical review workshop with the State of Alaska Department of Natural Resources geoscience team in support of the Alaska North Slope cooperative gas hydrate test site review effort (Anchorage, AK).

October 26-27, 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 (Denver, CO).

November 10, 2015: USGS staff participated in an Alaska North Slope gas hydrate test site review meeting (web meeting).

December 1, 2015: USGS staff participated in an Alaska North Slope gas hydrate test site review meeting (web meeting).

December 9-16, 2015: USGS staff (T.S. Collett) participated in the onshore field test of the UT-DOE Hybrid Pressure Core System (Cameron, TX). (DOE funds were not used to support this travel, included for informational purposes)

December 15, 2015: USGS staff participated in an Alaska North Slope well test planning meeting in support of the downhole logging and VSP program (web meeting).

January 11-15, 2016: USGS staff participated in a technical review workshop with the State of Alaska Department of Natural Resources geoscience team in support of the Alaska North Slope cooperative gas hydrate test site review effort (Anchorage, AK).

January 19, 2016: USGS staff participated in an Alaska North Slope gas hydrate test site review meeting (web meeting).

January 28, 2016: USGS staff participated in the US-DOE hosted Federal Interagency Technical Coordinating Committee (web meeting).

February 1-5, 2016: USGS staff participated in a technical review and project planning workshop in support of the India National Gas Hydrate Program (New Delhi, India). (DOE funds were not used to support this travel, included for informational purposes)

February 27, 2016: USGS staff participated in an Alaska North Slope gas hydrate test site review meeting (web meeting).

February 28 – March 4, 2016: USGS staff participated in the Gordon Research Conference on Natural Gas Hydrate Systems in Galveston, TX. Collett gave a presentation titled "Gas Hydrate Field Production Testing: Lessons Learned and Future Plans."

March 8, 2016: USGS staff participated in an Alaska North Slope gas hydrate test site review meeting (web meeting).

March 22, 2016: USGS staff participated in an Alaska North Slope gas hydrate test site review meeting (web meeting).

Publications (for the period 9/30/2015 - 3/31/2016)

Boswell, R., Bünz, S., Collett, T.S., Frye, M., Fujii, T., McConnell, D., Meinery, J., Pecher, I., Reichel, T., Ryu, B.-J., Shelander, D., and Shin, K.-S., 2016, Introduction to special section: Exploration and characterization of gas hydrates: Interpretation Journal Volume 4, Issue 1, 21 p.

Wang, X., Collett, T., Shi, H., Yang, S., Wang, Z., Chen, D., Li, Y., and Yan, C., 2016, Characterization of gas hydrate distribution using conventional three-dimensional seismic data in the Pearl River Mouth Basin, South China Sea: Interpretation Journal Volume 4, Issue 1, 12 p. (DOE funds were not used to support this publication, included for informational purposes)

Boswell, R., Schoderbek, D., Anderson, B., Collett, T.S., Ohtsuki, S., and White, M., (in review), The Iñalik Sikumi field experiment, Alaska North Slope: design, operations, and implications for CO₂-CH₄ exchange in gas hydrate reservoirs: Journal of Energy & Environmental Science.

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., (in review), Historical Methane Hydrate Project Review: Journal of Marine and Petroleum Geology.

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 of 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.

DOE, JOGMEC, USGS and State of Alaska Department of Natural Resources (SOA-DNR) technical staff is scheduled to convene a project workshop to identifying potential gas hydrate production test sites in the PBU. This SOA-DNR hosted site review effort will include the use confidential seismic data that will be strictly controlled by confidentiality agreements.

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 gas hydrates on the Alaska North Slope. The DOE, JOGMEC, and USGS leadership group will also submit to the PBU-WIO a draft gas hydrate test well plan in support of testing at the Kuparuk 7-11-12 site in the PBU.

COST STATUS

The total funds spent from this account during the period from 9/30/2014 through 3/31/2016) are summarized below along with the current project account balance.

Total DOE Award	\$	96,975.00
Expenses 10/1/2014 through 9/30/2015	\$	(23,927.00)
Overhead 10/1/2014 through 9/30/2015	\$	(11,034.00)
Expenses 10/1/2015 through 4/1/2016	\$	(2,771.00)
Overhead 10/1/2015 through 4/1/2016	\$	(1,564.00)
Project Account Balance	\$	57,679.00

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