

DOE Award No.: DE-FE0022898

# Research Performance Progress Report (Period Ending 9/30/2017)

## Alaska Natural Gas Hydrate Production Testing, Test Site Selection, Characterization and Testing Operations Project Period (09/01/2014 – 12/31/2017)

Submitted by:  
Timothy S. Collett

United States Geological Survey  
DUNS #: 137781949  
DFC, MS-939, Box 25046  
Denver, CO 80225  
Email: tcollett@usgs.gov  
Phone number: (303) 236-5731

Prepared for:  
United States Department of Energy  
National Energy Technology Laboratory

October 1, 2017



U.S. DEPARTMENT OF  
**ENERGY**

**NATIONAL ENERGY  
TECHNOLOGY LABORATORY**

Office of Fossil Energy

## **DISCLAIMER**

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

## **ABSTRACT**

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

DOE Award Number: DE-FE0022898

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 (10/1/2016 - 9/30/2017), the USGS has continued to contribute to the DOE- and industry-sponsored cooperative gas hydrate production testing project in northern Alaska. The USGS leads the geologic research effort in support of the test site selection and characterization efforts. Over this reporting period, most of the test site review effort has focused on characterizing the occurrence of gas hydrates at the PBU 7-11-12 proposed test site and assessing suitability of this site for an extended gas hydrate production test. The USGS geologic and geophysical studies of the Eileen Gas Hydrate Trend in the greater PBU area have determined that the PBU 7-11-12 test site possesses known gas hydrate occurrences and the existing infrastructure (i.e., gravel pad) required for a successful production test. The USGS has also continued to support DOE-led gas hydrate production modeling efforts, including the preparation of reservoir model input information from other production testing efforts. The formal planning for the next gas hydrate production test on the Alaska North Slope has continued over this reporting period, with the USGS providing guidance and technical support to the DOE and their potential industry partners and others (including JOGMEC and PRA). The USGS has provided technical information and reviews of specific components of the future drilling and production testing program, including, but not limited to, drilling operations, analysis of physical properties of conventional and pressure cores, planning for post-field testing of cores, core flow, and downhole logging and coring plans. The USGS has also taken the lead on the technical evaluation of advanced drill site and borehole acquisition systems needed to monitor the response of the gas hydrate reservoirs and completion systems to the production of hydrates over the duration of the planned field test. During this reporting period, the USGS co-hosted a test site review and production well test design meetings and the USGS also contributed to a series of biweekly web style meetings in support of this effort.

TABLE OF CONTENTS

Disclaimer ..... 2

Abstract ..... 3

Table of Contents ..... 4

Executive Summary ..... 5

Cost Status ..... 14

## 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 Gas Hydrate Trend. This project consists of one task that includes two subtasks. The first subtask involves the geologic and engineering assessment of gas hydrate accumulations in the Eileen Gas Hydrate Trend. 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. The USGS has continued to play a key role in the planning for a DOE sponsored gas hydrate production test on the Alaska North Slope, focusing on further characterizing the PBU 7-11-12 gas hydrate test site and contributing to the design of the actual test well program. Most of our test site review effort was refocused during this reporting period to assess gas hydrate prospects in the Westend of the Prudhoe Bay Unit (PBU) including the PBU 7-11-12 proposed test site. The USGS geologic and geophysical studies of the Eileen Gas Hydrate Trend in the greater PBU area have determined that the PBU Kuparuk 7-11-12 test site includes known gas hydrate occurrences and the existing infrastructure (i.e., gravel pad) required for a successful production test. The USGS in cooperation with the Japan Oil, Gas and Metals National Corporation (JOGMEC), DOE, and SOA Department of Natural Resources (SOA-DNR) led the effort that identified and characterized the PBU 7-11-12 prospect, which elevated this prospect as the lead site for the proposed production test pilot. The project leadership group of DOE, JOGMEC, and the USGS are currently working with Prudhoe Bay Unit Working Interest Owners to gain access to PBU 7-11-12 for the proposed government-industry led gas hydrate production test.

Formal engineering and operational planning for the next gas hydrate production testing project in northern Alaska has also continued, with the USGS providing guidance and technical support to the DOE and JOGMEC. In February-2017, the USGS participated in a test site review and production well test design meeting in Anchorage, Alaska that was attended by JOGMEC and DOE technical staff. The USGS has also contributed to a series of bi-weekly web style meetings in support of this effort. The USGS technical planning effort in support of the Alaska gas hydrate production test has led to the development of a comprehensive test well engineering and operational plan. 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 the presence of viable test

reservoirs, the proponents would propose to proceed into Phase 2 and the establishment 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 the 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 and gas hydrate research labs in the US and Japan. 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.

The goal of planned gas hydrate production test testing phase is to observe the long-term response of a gas hydrate reservoir and associated seals to long-term dissociation by depressurization. The intent is to obtain production rates that are stable and measureable over sufficient time to ensure that drilling- and completion-induced transient phenomena have been resolved. A successful well is one in which the observed response can be confidently used to assess the controls on commercial production of gas hydrates. The target rates will be scaled to those that can be logistically handled within the available or project developed infrastructure. A major design concern has been the project requirements for the handling and disposal of gas and water produced during the production test. Although periodic flaring during operation may be conducted per unit operator protocols, gas produced during the test phase of the project will not be flared. The project team has continued to develop gas handling options, which may include local heating use or transport to nearby facilities for use or disposal. The project recognizes that excessive gas production will be an operational and logistical burden for the project, so the test plan is designed to flow the well at pre-set rates that will be mutually-determined to be manageable, but that will still allow the project to fully assess reservoir deliverability and potential reservoir behavior. The co-production of water also needs to be dealt with in the engineering design of the gas hydrate test well program.

During this reporting period, the USGS has contributed to gas hydrate production response modeling of both the Unit B and Unit D gas hydrate reservoir units at the proposed PBU 7-11-12 test site. The modeling groups in JOGMEC and the DOE-NETL have led independent efforts to model the production response of the of the gas hydrate reservoirs at the test site. The USGS has contributed to this effort by providing the required geologic and engineering input data and assumptions needed to build accurate reservoir production models for the PBU 7-11-12 test site. These production models indicate that water production is likely to occur at manageable rates (of about 1000 to 3000 bwpd) that can be collected on site and trucked to suitable disposal facilities; however, contingencies for higher predicted water production rates will also be developed in consultation with the test well operator. These modeling efforts also show that the gas production rates could reach values as high as 1,000 mscf/day, which would need to be considered in the gas hydrate test well design plan.

Within the gas hydrate field test planning effort, the USGS has also taken the lead on development of an integrated "Statement of Requirements" or SOR for the proposed test well program. This document systematically reviews the "scientific and engineering requirements" that need to be addressed under what is being currently planned as a three well testing program; consisting of a (1) stratigraphic test well that will be likely converted to an observation well designed to monitor the hydrate production test to be conducted at this site; (2) a geoscience test well that will include the acquisition pressure cores and research suite of wireline logs, this well may also be converted to a second observation well; and (3) the third well will be the actual test well that will be extensively wireline logged and instrumented to monitor the response of the hydrate-bearing reservoir to depressurization and production. This SOR also contains an assessment of the relative importance of the listed "scientific and engineering requirements" to achieving the overall goals of the planned production test. This SOR also includes a detailed list and analysis of the measurements and systems to be used to obtain the required samples and data during this testing program. The SOR also assesses the operational limitations of each measurement systems to be used during the test.

The USGS publication efforts during this reporting period have focus on supporting the ongoing gas hydrate production testing research efforts in northern Alaska. These contributions included a comprehensive review of the "Iññik Sikumi gas hydrate production test results in a paper titled the "Iññik Sikumi Field Experiment, Alaska North Slope: Design, Operations, and Implications for CO<sub>2</sub>-CH<sub>4</sub> Exchange in Gas Hydrate Reservoirs." The USGS also contributed to a production modeling journal article that focused on simulating gas production and mechanical response of the known gas hydrate accumulation in the area of the PBU L production pad in the Westend of the Prudhoe Bay Unit. The contributions of this project to the proceedings of the 9th International Conference on Gas Hydrates dealt mostly with the development of a series of eight gas hydrate production modeling research papers that helped to define the geologic and engineering controls on the production of gas hydrates. From April 16th through May 12th, Tim Collett (USGS Gas Hydrate Energy Project Manager) participated in an 18 city AAPG Distinguished Lecture Tour that featured presentations on Arctic gas hydrate petroleum systems, Arctic gas hydrate production testing, and integrated seismic and well log analysis of gas hydrate prospects. Collett also gave the Key Note opening address, titled *Why Not Gas Hydrates?*, at the 9th International Conference on Gas Hydrates.

#### **Project Meetings, Outreach, and Presentations (for the period 10/1/2016 - 9/30/2017)**

October 1, 2016 through September 31, 2017: USGS staff organized and/or contributed to the following regular weekly and biweekly meetings and briefings in support of numerous USGS and DOE funded/participating project efforts:

- Alaska North Slope Gas Hydrate Production Testing project sponsor meetings with representatives from DOE, NETL, USGS, JOGMEC, PRA, and various project members and leadership.

- University of Texas, Gulf of Mexico 2 Gas Hydrate Project planning meetings with representatives from DOE, NETL, USGS, LDEO, Helix, Geotek, and various project members and leadership.
- India NGHP-03 Expedition project planning and gas hydrate production modeling meetings with representatives from DOE, NETL, USGS, LBNL, ONGC, AIST, University of Pittsburgh, and the Rensselaer Polytechnic Institute.
- Alaska North Slope Gas Hydrate Life Cycle Assessment project meetings with the members of the West Virginia University Gas Hydrate Production Modeling Group.
- 9th International Conference of Gas Hydrates Local Organizing Committee weekly conference planning meetings.
- 2018 Gordon Conference of Gas hydrates organizing committee monthly planning meetings (Collett-USGS 2018 Conference Co-Chair).

October 12, 2016 through March 14, 2017: Colorado School of Mines special lecture series on gas hydrates. USGS led a total of three topical gas hydrate lectures: (1) Review of ongoing international gas hydrate research efforts [Collett], (2) Seismic characterization of gas hydrates in marine environments [Haines], and (3) Geologic and engineering controls on the production of gas hydrates [Collett].

October 19, 2016: USGS staff contributed a technical briefing on the status of international gas hydrate research efforts during the DOE Methane Hydrate Advisory Committee Meeting in Washington, DC.

November 17-18, 2016: USGS staff participated in the Colorado School of Mines Fall Reservoir Characterization Project meetings in Golden, Colorado.

November 28 through December 2, 2016: USGS staff co-hosted and participated in a technical review and project planning workshop in support of the India National Gas Hydrate Program (New Delhi and Mumbai, India). (DOE funds were not used to support this travel, included for informational purposes)

December 5-7, 2016: USGS staff attended 12th International Oil & Gas Conference and Exhibition (Petrotech-2016) and gave a key-note technical presentation titled *India National Gas Hydrate Program Expedition 02 Technical Contributions* (New Delhi, India). (DOE funds were not used to support this travel, included for informational purposes)

December 10-11, 2016: USGS staff contributed to the DOE-LBNL Gas Hydrate Production and Mechanical Modeling Workshop, convened at the LBNL in Berkeley, California.

January 18-20, 2017: USGS staff participated in a University of Texas Gulf of Mexico Gas Hydrate Drilling Program planning and organizational meeting (Austin, Texas).

February 1, 2017: USGS staff participated in a South China Sea Gas Hydrate Production Modeling workshop hosted by Dr. Fulong Ning of the China University of Geosciences (Wuhan), convened at the Colorado School of Mines (Golden, Colorado).

February 13-16, 2017: The USGS participated in a high-level workshop in Anchorage, Alaska with representatives from the US Department of Energy (DOE), Japan Oil, Gas



and Metals National Corporation (JOGMEC), SOA Department of Natural Resources and the Prudhoe Bay Unit Working Interest Owners, which had the goal to develop an effective management structure for the proposed Alaska North Slope extended gas hydrate production test. This series of meetings also led to the development of a draft technical and operational plan for the ANS gas hydrate test.

February 17, 2017: USGS staff (Collett) gave an invited lecture on Marine Gas Hydrate Prospecting and Reservoir Characterization at the University of Colorado (Boulder, Colorado).

February 22-23, 2017: USGS staff (Collett) gave a series of three class lectures dealing with Well Log Characterization of Gas Hydrate Reservoir Systems at the Colorado School of Mines (Golden, Colorado).

March 6-10, 2017: USGS staff participated in a series of USGS Energy Resources Program project review meetings (Reston, Virginia).

March 22-24, 2017: USGS staff (Collett) participated in a University of Texas Gulf of Mexico Gas Hydrate Drilling Program planning meetings and Gulf of Mexico Safety Training sessions (Houston, Texas).

March 30, 2017: USGS staff (Collett) participated in a one day review meeting dealing with the BOEM gas hydrate assessment methodology, coordinated by Jack Schuenemeyer (Denver, Colorado).

April 4-6, 2017: USGS staff participated in the Colorado School of Mines Spring Reservoir Characterization Project meetings in Golden, Colorado.

April 21, 2017: USGS staff (Collett) participated remotely (Webex) in the University of Texas Gulf of Mexico Gas Hydrate Drilling Program *UT-GOM-2-1 Expedition* Pre-Spud Meeting (Houston, Texas).

April 16th through May 12th, 2017: Tim Collett (USGS) AAPG Distinguished Lecture Tour, total of 18 lectures.

May 2-3, 2017: USGS staff (Collett) participated remotely (Webex) in the IODP-EPSP Review of the University of Texas Gulf of Mexico Gas Hydrate Drilling Program *UT-GOM-2-2 Expedition* Operational Plan (College Station, Texas).

May 12-23, 2017: USGS staff (Collett) participated in University of Texas Gulf of Mexico Gas Hydrate Drilling Program *UT-GOM-2-1 Expedition*.

May 23-26, 2017: USGS staff (Collett) participated in University of Texas Gulf of Mexico Gas Hydrate Drilling Program *UT-GOM-2-1 Expedition* post-expedition pressure core processing and analytical efforts (Fourchon, Louisiana).

June 25-30, 2017: Co-Chaired and participated in the 9th International Conference on Gas Hydrates (ICGH9) (Denver, Colorado). Collett also gave the Key Note opening

address at the conference that was titled *Why Not Gas Hydrates?* USGS scientist also led and/or contributed to a total of nine paper submissions and presentations to ICGH9.

July 1-3, 2017: USGS staff (Collett) participated in a series of project review meetings dealing with US-China cooperative gas hydrate research interest. Meeting participants included Dr. Jin Qian and Dr. Xiujuan Wang from the Institute of Oceanology and Key Laboratory of Marine Geology and Environment, Chinese Academy of Sciences (Denver, Colorado).

July 25-27, 2017: USGS staff participated in a series of USGS CERSC project review meetings (Denver, Colorado).

August 31 through September 22, 2017: Tim Collett (USGS) Ocean Discovery Lecturer Series tour, total of 6 lectures.

September 2017: The USGS staff participated in a high-level workshop in Anchorage, Alaska with representatives from the US Department of Energy (DOE), Japan Oil, Gas and Metals National Corporation (JOGMEC), SOA Department of Natural Resources and the Prudhoe Bay Unit Working Interest Owners, which had the goal to develop an operational plan for the proposed Alaska North Slope Gas Hydrate Production Testing Project.

#### **Publications: The period 10/1/2016 - 9/30/2017**

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

Myshakin, E., Ajayi, Taiwo, Anderson, B.J., Seol, Y., and Boswell, R., 2016, Numerical simulations of depressurization-induced gas production from gas hydrates using 3-D heterogeneous models of L-Pad, Prudhoe Bay Unit, North Slope Alaska: Journal of Natural Gas Science and Engineering, v. 35, p. 1336-1352.

Nandanwar, M., Anderson, B., Ajayi, T., Collett, T., and Zyrianova, M., 2016, Evaluation of gas production potential from gas hydrate deposits in the National Petroleum Reserve Alaska using numerical simulations: Journal of Natural Gas Science and Engineering, v. 30, p. 760-772.

Wang, X.J., Qian, J., Collett, T.S., Shi, H., Yang, S., Yan, C., Li, Y., Wang, Z., Chen, D., 2016, Characterization of gas hydrate distribution using conventional 3D seismic data in the Pearl River Mouth Basin, South China Sea: Interpretation, v. 4, p. SA25-SA37. (DOE funds were not used to support this publication, included for informational purposes)

Boswell, R., Schoderbek, D., Collett, T.S., Ohtsuki, S., White, M., and Anderson, B., 2017, The Ignik Sikumi Field Experiment, Alaska North Slope: Design, operations, and

implications for CO<sub>2</sub>-CH<sub>4</sub> exchange in gas hydrate reservoirs: *Journal Energy and Fuels*, v. 31, p. 140-153.

Demas, A., 2017, Exploring Gas Hydrates as a Future Energy Source: U.S. Geological Survey Transition Information, November-2016, 2 p. <https://www.usgs.gov/center-news/exploring-gas-hydrates-a-future-energy-source>

Haines, S.S., Hart, P.E., Collett, T.S., Shedd, W.W., Frye, M., Weimer, P., and Boswell, R., 2017, High-resolution seismic characterization of the gas and gas hydrate system at Green Canyon 955, Gulf of Mexico, USA: *Journal of Marine and Petroleum Geology*, v. 82, p. 220-237.

Riedel, M., and Collett, T.S., 2017, Observed correlation between the depth to base and top of gas hydrate occurrence from review of global drilling data: *Journal of Geochem. Geophys. Geosyst.*, v. 18, 19 p. doi:10.1002/ 2017GC006805.

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*, 125 p.

Lorenson, T.D., and Collett, T.S., (in review), Nation Gas Hydrate Program Expedition 01 offshore India gas hydrate petroleum systems as revealed by hydrocarbon gas geochemistry: *Journal of Marine and Petroleum Geology*, 39 p.

Qian, J., Wang, X., Collett, T.S., Chen, D., Guo, Y., Su, P., Liang, J., Dong, D., and Zhanga, G., (in review), Stratified and high saturation gas hydrate within fine-grained sediments in the Pearl River Mouth Basin, South China Sea: *Journal of Marine and Petroleum Geology*, 29 p.

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 and Environmental Science*, 36 p.

**Publications: Proceedings 9th International Conference on Gas Hydrates (06/25-30/2017) - Conference distributed flash memory (no web posting)**

Boswell, R., Collett, T.S., Myshakin, E., Ajayi, T., and Seol, Y., 2017, The increasingly complex challenge of gas hydrate reservoir simulation: *Proceeding of the 9th International Conference on Gas Hydrates*; June 25-30, 2017; Denver, Colorado, USA, 10 p.

Dai, S., Jang, J., Lee, J.Y., Seol, Y., and Waite, W.F., 2017, What has been learned from pressure cores: *Proceeding of the 9th International Conference on Gas Hydrates*; June 25-30, 2017; Denver, Colorado, USA, 13 p.

Flemings, P.B., Boswell, R., Collett, T.S., Cook, A.E., Divins, D., Frye, M., Goldberg, D.S., Malinverno, A., Meazell, K., Morris, J., Pettigrew, T., Philips, S., Santra, M., Sawyer, D.K., Shedd, W., Thomas, C., and You, K., 2017, GOM2: Prospecting, drilling and sampling coarse-

grained hydrate reservoirs in the deepwater Gulf of Mexico: Proceeding of the 9th International Conference on Gas Hydrates; June 25-30, 2017; Denver, Colorado, USA, 9 p.

Haines, S.S., Collett, T.S., Hart, P.E., Shedd, W., Weimer, P., Frye, M., and Boswell, R., 2017, High-resolution seismic imaging of depositional characteristics at gas hydrate research sites in the Gulf of Mexico: Proceeding of the 9th International Conference on Gas Hydrates; June 25-30, 2017; Denver, Colorado, USA, 2 p.

Lewis, K., and Collett, T.S., 2017, Brookian Sequence Well Log Correlation Sections and the Occurrence of Gas Hydrates along the North-Central North Slope of Alaska: Proceeding of the 9th International Conference on Gas Hydrates; June 25-30, 2017; Denver, Colorado, USA, 2 p.

Myshakin, E.M., Lin, J.S., Uchida, S., Seol, Y., Collett, T.S., and Boswell, R., 2017, Numerical studies of depressurization-induced gas production from an interbedded marine turbidite gas hydrate reservoir model: Proceeding of the 9th International Conference on Gas Hydrates; June 25-30, 2017; Denver, Colorado, USA, 18 p.

Uchida, S., Lin, J.S., Myshakin, E.M., Seol, Y., Collett, T.S., and Boswell, R., 2017, Numerical simulations of sand production in interbedded hydrate-bearing sediments during depressurization: Proceeding of the 9th International Conference on Gas Hydrates; June 25-30, 2017; Denver, Colorado, USA, 10 p.

Zyrianova, M.V., Collett, T.S., and Boswell, R., 2017, Characterization of the structural-stratigraphic and reservoir controls on the occurrence of gas hydrate in the Eileen Gas Hydrate Trend, Alaska North Slope: Proceeding of the 9th International Conference on Gas Hydrates; June 25-30, 2017; Denver, Colorado, USA, 2 p.

### **Project Near-Term Work Plan**

Over the next project reporting period, the USGS will continue to play a key role in the planning for a DOE-JOGMEC-USGS sponsored gas hydrate production test on the Alaska North Slope, focusing on further characterizing the PBU Kuparuk 7-11-12 gas hydrate test site and contributing to the design of the test well program.

The cooperative USGS, JOGMEC, DOE, and PRA studies of Alaska North Slope gas hydrate resource distribution indicates that the PBU 7-11-12 site offers the best location for a potentially successful world-first long-term gas hydrate production test. During the planned "Appraisal Stage" of upcoming detailed analysis of the PBU 7-11-12 site, the USGS, JOGMEC, DOE, and PRA partnership plans to conduct a geophysical review of newly provided reprocessed 3D seismic data to validate the previous DNR-USGS test site review results. If needed, this review may be extended to modify the current plan for the three-well gas hydrate production test program; for example either the surface or bottom hole locations could be modified based on this work.

The Alaska North Slope test well plan calls for the inclusion of an extensive well instrumentation and monitoring program. Assuming success of the initial Stratigraphic Test Well, it may be outfitted with an advanced set of measurement systems (strapped to casing and cemented in place). These systems will also be incorporated into the

design of the geoscience/observation well and the main production test well, which will be used to monitor downhole conditions throughout the duration of the field test program. This USGS has been taking the lead on the technical review of the suitability of existing industry wellbore monitoring systems in their application to characterizing the response of the gas hydrate reservoirs to depressurization and gas production. In the near-term, the USGS will continue to work with providers of proven industry developed distributed (DTS, DAS, DSS) and gage based wellbore monitoring systems to evaluate their potential contribution of these systems to the Alaska North Slope gas hydrate test program.

In summary, the USGS will continue to (1) provide technical and scientific leadership for the formulation of research drilling and production testing program designed to assess the nature and production potential of gas hydrates on the Alaska North Slope, (2) provide personnel and resources to conduct field and laboratory analyses of material recovered by conventional and pressure core systems, and (3) partner in the synthesis of data from logging, direct sampling, and geophysical and geologic characterization studies.

## COST STATUS

The total funds spent from this account during the period from 9/30/2014 through 9/30/2017) are summarized below along with the current project account balance.

Total DOE Award (FY2015-FY2017)	\$	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 3/31/2016	\$	(2,771.00)
Overhead 10/1/2015 through 3/31/2016	\$	(1,564.00)
Expenses 4/1/2016 through 9/30/2016	\$	(3,026.00)
Overhead 4/1/2016 through 9/30/2016	\$	(1,708.00)
Expenses 10/1/2016 through 8/1/2017	\$	(9,333.00)
Overhead 10/1/2016 through 8/1/2017	\$	(5,350.00)
Project Account Balance (carryover into FY2018)	\$	38,262.00

## National Energy Technology Laboratory

626 Cochran's Mill Road  
P.O. Box 10940  
Pittsburgh, PA 15236-0940

3610 Collins Ferry Road  
P.O. Box 880  
Morgantown, WV 26507-0880

1450 Queen Avenue SW  
Albany, OR 97321-2198

Arctic Energy Office  
420 L Street, Suite 305  
Anchorage, AK 99501

Visit the NETL website at:  
[www.netl.doe.gov](http://www.netl.doe.gov)

Customer Service Line:  
1-800-553-7681



U.S. DEPARTMENT OF  
**ENERGY**

**NATIONAL ENERGY  
TECHNOLOGY LABORATORY**