NATIONAL ENERGY TECHNOLOGY LABORATORY

DOE Award No.: FP00008137 **OIL & GAS**

Quarterly Research Performance Progress Report)

(Period Ending 12/31/2018)

BEHAVIOR OF SEDIMENTS CONTAINING METHANE HYDRATE, WATER, AND GAS SUBJECTED TO GRADIENTS AND CHANGING CONDITIONS

Project Period (October 1, 2018 to September 30, 2019)

Submitted by:
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Signature

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

Resubmitted March 7, 2019

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RESEARCH PERFORMANCE PROGRESS REPORT

DISCLAIMER

ACCOMPLISHMENTS:

Task 1.0 Project Management Plan

The Recipient shall work together with the NETL project manager to maintain and update the project management plan (PMP) to be submitted at FWP approval (and formatted in accordance with the guidance provided by NETL). In the event of major modifications to the FWP an update of the PMP shall be submitted to the NETL project manager within 30 days. The NETL Project Manager shall have 20 calendar days from receipt of the revised PMP to review and provide comments to the Recipient. Within 15 calendar days after receipt of the NETL Project Manager's comments, the Recipient shall submit a final revised PMP to the NETL Project Manager for final review and approval.

Budget	$2K
Estimated Schedule	Within 1 month of receipt of funding (draft submitted with FWP)

Update:

Task 2. Laboratory benchmark geomechanical tests for code validation

Recent code comparison studies have identified a number of interesting geomechanical problems to challenge codes. The codes are able to predict various behaviors over time, however little to no field or laboratory data are available to test the codes against. In this task, we will develop a limited data set for comparison to hydrate geomechanical simulators. Particular attention will be given to the habit of hydrate and its saturation. These 2 factors will likely control behavior of the samples under load.

Subtask 2a. Design task with feedback from geomechanical modelers

Feedback will be sought to design a laboratory geomechanical test. As an example, the Terzaghi problem is suggested. Code developers for the TOUGH+ and STOMP simulators (and others) will be queried about creating a set of laboratory tests. Two methods will be used. First, we will request some time during one of the International Gas Hydrate Code Comparison 2 (IGHCC2) telecons to broach the problem and seek feedback. Sometimes in large groups feedback is difficult, so the second approach will be to contact code developers individually through e-mail following the IGHCC2 presentation to seek feedback.

Budget	$2K

Estimated Schedule	Within 1 month of receipt of funding

Update: Feedback has been sought from the ICCGH2 group and the modelers were helpful is providing suggestions.

Subtask 2b. Test design and construction in existing or off-the-shelf pressure equipment

Ideas from Task 1a will be evaluated and converted into a test apparatus that will be assembled in an existing or off-the-shelf pressure vessel. LBNL has a number of vessels available for use, in addition to temperature control systems and ancillary pressure equipment. Custom test devices will be constructed to go into these vessels. Of course, it will not be possible to perform a lab test on the km scale as is modeled in the IGHCC2, but appropriate scales will be used. If possible, tests will be performed in X-ray transparent vessels to add information to system behavior (current assumptions are typically “uniform” or “equilibrium”).

Budget	$43K
Estimated Schedule	Within 3 months of receipt of funding

Update: New components have been designed for use on the inside of an existing pressure vessel. New data analysis methods are being composed to provide accurate subvoxel resolution measurements of sample length.

Subtask 2c Perform a series of tests (cementing hydrate)

Tests will be performed at a number of hydrate saturations (3 or more, e.g. 15%, 30%, 50%, 60%, 80%) using cementing hydrate. For example, using the Terzaghi problem, the test will be assembled, and hydrate formed at Saturation 1. Consolidation over time will be recorded for stable and unstable conditions. The test will be repeated at Saturations 2, 3, ...

Budget	$45K
Estimated Schedule	Within 8 months of receipt of funding

Update: Expected to start in March

Subtask 2d. Devise transfer method/sample composition for pore-filling hydrate

Aside from Subtask 1c, we will work on a reasonable method of creating pore-filling or load-bearing hydrate in porous media. We anticipate mixing crushed ice or frost flakes into the porous medium, applying an overburden, and making hydrate from the ice.

Budget	$10K
Estimated Schedule	Within 8 months of receipt of funding

Update: The new vessel internal components were designed with this in mind. Testing is still required.

Subtask 2e. Perform tests on pore-filling hydrate

Subtask 1c will be repeated with the pore-filling hydrate at a number of hydrate saturations (3 or more, e.g. 15%, 30%, 50%, 60%, 80%) to examine the impact of the habit of hydrate.

Budget	$45K
Estimated Schedule	Within 12 months of receipt of funding

Update: None

D. DELIVERABLES

Deliverables and Milestone Table

Deliverable	Brief Description	Planned Completion Date	**Actual Completion Date**	**Status / Results**
Updated Project Management Plan	Provides an update of how the project will be executed, monitored, and controlled in meeting the programmatic goals and objectives. Includes a detailed discussion about risk identification, mitigation and management.	Due 30 days **after any major project modification**	07/31/2018	
Geomechanical Test Design (2a, 2b)	Written report including test plan and design of test equipment/modifications.	November 30, 2018	3/7/2019	Late because documentation incomplete.
Geomechanical Test Cementing and Pore Filling Hydrate (2c – 2e)	Written report containing completed design information and description of measurements made and applicability to simulation.	July 31, 2019		
Research Performance Progress Report	Provides a narrative assessment of the technical, milestone/schedule, and cost status of the research. Measures changes in schedule or completion status of the originally planned milestones (as set forth in the Project Management Plan) and their actual completion dates. Monitors actual costs against baseline costs provided in the Project Management Plan	On or before 30th day after each quarter	Submitted 1/25/19 Modified and resubmitted 3/7/2019	Milestones added to Deliverables Table
Annual Research Performance Progress Report	Full account of progress, problems encountered, significant accomplishments, and approaches to be taken the following year. Includes status of milestones/schedule	Within 60 days after end of project year		

	and cost.			
Final Technical Report	Full account of all work performed during the project period in a comprehensive manner.	Within 90 days after project ends		
Topical Report (as needed)	Provide a comprehensive statement of the technical results of the work performed for a specific task or subtask or detail significant new scientific or technical advances.	Within 45 days of request		
Topical Report	A report documenting the design and construction of a laboratory system allowing investigation of geomechanics of hydrate-bearing sediments.	Within 4 months of receipt of funding		Much of this is contained in Milestone Geomechanical Test Design (2a, 2b) above. This information will be formalized and resubmitted.
Topical Report	A report detailing the geomechanical behavior of hydrate-bearing sediments under various saturations and habits	Within 13 months of receipt of funding		
Conference Papers/ Proceedings/ Articles	Documents include conference papers, proceedings, presentations, journal articles, and press releases.	Minimum of 7 business days prior to submission		
Ad hoc photos/ illustrations/ data	Photos, illustrations, diagrams, and related research data that can be used by SCC-OCP for presentations and other program documentation	As requested		

PRODUCTS:

None

CHANGES/PROBLEMS:

None

SPECIAL REPORTING REQUIREMENTS:

None

BUDGETARY INFORMATION:

	Actual Cost (this quarter)	**Actual Cost (cumulative for BP)**	**Funds available (for the BP)**	**Balance of unspent funds (for the BP)**	**Actual Cost (cumulative for the full FWP)**	**Funds available (for the full FWP)**	**Balance of unspent funds (for the full FWP)**
Jul-Sep 2017	$2,170	$2,170	$145,000	$142,830	$2,170	$145,000	$142,830

*This chart does NOT include Encumbrances

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