

Oil & Natural Gas Technology

DOE Award No.: DE-FC26-06NT42666

Quarterly Progress Report (January – March 2009)

Comparative Assessment of Advanced Gas Hydrate Production Methods

Submitted by:
Battelle Pacific Northwest Division
Richland , WA

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

April 10, 2009



Office of Fossil Energy

**Award No. DE-FC26-05NT42666
Battelle Pacific Northwest Division**

**Gas Hydrates Assessment
B. Peter McGrail, Principal Investigator**

Quarterly Report – Q2 (FY2009)

Executive Summary

This project will compare and contrast, through numerical simulation, conventional and innovative approaches to producing methane from gas hydrate-bearing geologic reservoirs. Initially, the project will investigate the production of gas hydrates from idealized reservoir configurations. If the initial investigation shows promise for the innovative approaches, additional simulation studies will be conducted using actual gas hydrate reservoir data from the Alaska North Slope (ANS) region.

Results of Work During Reporting Period

Phase I

Task 1: Project Management

Project management activities were minimal during the quarter consisting of tracking technical progress and spending, and quarterly reporting.

Task 2: Technology Status Assessment

This task was completed in the third quarter of this year with the submission of the summary report.

Task 3: Reservoir Simulation

Substantial progress was made during this quarter on the simulations for project completion to quantitatively investigate the nature of the three production technologies for the four hydrate classes:

- Class 1 - Hydrate bearing zone above a free-gas (mobile-gas) zone within a permeable formation, where the lower hydrate stability boundary occurs at the hydrate-gas boundary and the upper hydrate stability boundary occurs above the permeable formation;
- Class 2 - Hydrate bearing zone overlying a free-aqueous (mobile-aqueous) zone within a permeable formation;
- Class 3 - Hydrate bearing zone occupying the entire permeable formation, thus without either a free-gas or -aqueous (mobile-gas or -aqueous) zone;
- Class 4 - Disperse, low saturation accumulations of gas hydrates without confining overburden and underburden strata (e.g., suboceanic deposits).

Results from the series of simulations focusing on Class 1 gas hydrate simulations were collected and analyzed for submission of a publication in the Mt. Elbert Special Edition of the

Journal of Marine and Petroleum Geology. These simulations investigated the injection of carbon dioxide in three forms: 1) pure CO₂, 2) 50% CO₂ microemulsion, and 3) dissolved CO₂ over a range of injection pressures and temperatures, following an initial depressurization stage. The main conclusions from these results are that the higher permeability gas zone limited the needed direct contact of carbon dioxide with the natural gas hydrate to efficiently drive guest molecule exchange (i.e. the Conoco-Phillips method). These results and conclusions are directly transferable to Class 2 gas hydrate accumulations that also have a high permeability zone underlying the hydrate zone.

During the next quarter, we will complete analysis and review of all remaining simulation work in preparation for submission of the project final report by June 30. This includes a review and analysis of recent simulations investigating the production of Class 3 and 4 gas hydrate accumulations, using the same approach taken previously. Our expectation is to capture these findings in the final report but eventually also publish the results in the scientific literature. The final report will summarize and document production analyses for all four classes of hydrate accumulations.

Significant Issues and Corrective Action

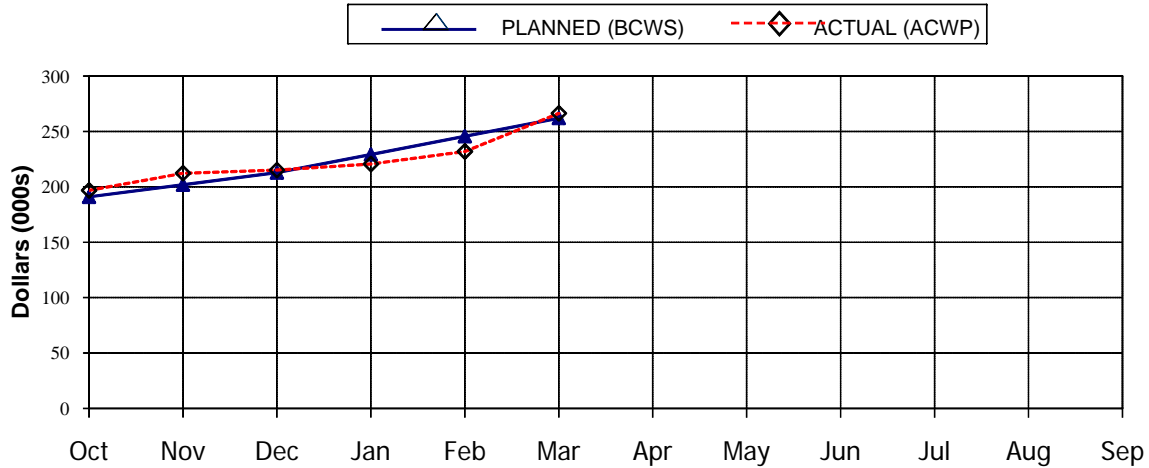
None.

Publications and Presentations

None.

48984 Gas Hydrates Assessment
Planned and Actual Cumulative Spending Curve
(DOLLARS IN THOUSANDS)

Jan - March 09



(\$K)	FY08 TD	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	FY09
Planned Cost	180.00	10.94	10.94	10.94	16.41	16.41	16.41	16.40	16.40	16.40	0.00	0.00	0.00	311.3
Actual Cost by Month	179.3	17.5	15.5	2.8	5.5	11.3	34.4	0.0	0.0	0.0	0.0	0.0	0.0	266.3
Variance Cost	0.7	-6.6	-4.6	8.1	10.9	5.1	-18.0	16.4	16.4	16.4	0.0	0.0	0.0	
Cumulative Planned	180.0	190.9	201.9	212.8	229.2	245.6	262.1	0.0	0.0	0.0	0.0	0.0	0.0	
Cumulative Actual	179.3	196.8	212.3	215.1	220.6	231.9	266.3	0.0	0.0	0.0	0.0	0.0	0.0	
Cumulative Variance	0.7	-5.9	-10.4	-2.3	0.0	13.7	-4.3	0.0	0.0	0.0	0.0	0.0	0.0	

MILESTONES	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	FY09
Complete Task 3 Simulations	△												
Issue Final Report	△												
Quarterly Reports	☆												
LEGEND	SCHEDULED △												
	DEVIATION □												
	COMPLETED ☆												
	TIME LINE —												
	ELIMINATED BY REDUCTION ●												

National Energy Technology Laboratory

626 Cochrans Mill Road
P.O. Box 10940
Pittsburgh, PA 15236-0940

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

One West Third Street, Suite 1400
Tulsa, OK 74103-3519

1450 Queen Avenue SW
Albany, OR 97321-2198

2175 University Ave. South
Suite 201
Fairbanks, AK 99709

Visit the NETL website at:
www.netl.doe.gov

Customer Service:
1-800-553-7681

