

# Oil & Natural Gas Technology

DOE Award No.: DE-FE0010667

## Research Performance Progress Report

Quarterly Report: October 2016 to December 2016

### Liquid-Rich Shale Potential of Utah's Uinta and Paradox Basins: Reservoir Characterization and Development Optimization

Project period: October 1, 2012 to September 30, 2015 (extended to March 31, 2017)



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A handwritten signature in black ink, appearing to read "Michael D. Vanden Berg".

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

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Office of Fossil Energy



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## EXECUTIVE SUMMARY

As the project progresses through its second no-cost extension, several different research activities are still on track to help better characterize Utah's tight oil plays. Core analysis, outcrop examination, and regional mapping activities are helping to create a clearer understanding of the Uteland Butte tight oil play, and several research projects on the Cane Creek shale are nearing completion. The current 6-month no-cost extension was requested to give graduate students working on the project a little more time to finalize their theses. The final project ending date is still slated for March 31, 2017.

Technology transfer remains a vital tool for communicating the project results with interested stake holders. Two project-related oral presentations were given at the AAPG Rocky Mountain and Pacific Section meeting, which was held in Las Vegas, Nevada, in early October 2016. In addition, a major paper on the Uteland Butte portion of the project was published by the Rocky Mountain Association of Geologists (RMAG) in December 2016.

## PROGRESS, RESULTS, AND DISCUSSION

### Task 1.0: Project Management Plan

During October 2016, the PI wrote and submitted the project's 16<sup>th</sup> quarterly report for July to September 2016. This report was subsequently sent via email to all interested parties and posted on the UGS project website. In addition, the PI updated the Project Summary in November and posted it to the project website.

### Task 2.0: Technology Transfer

- The UGS project website was updated with new information:  
[http://geology.utah.gov/emp/shale\\_oil](http://geology.utah.gov/emp/shale_oil)
- The PI completed the 16<sup>th</sup> quarterly report and emailed it to all interested parties. The report is also available on the UGS project website.
- New publication on Uteland Butte member:
  - Birdwell, J., Vanden Berg, M.D., Johnson, R.C., Mercier, T.J., Boehlke, A.R., and Brownfield, M.E., 2016, Geological, Geochemical, and Reservoir Characterization of the Uteland Butte Member of the Green River Formation, Uinta Basin, Utah, *in* Dolan, M.P., Higley, D.K., and Lillis, P.G., editors, Hydrocarbon Source Rocks in Unconventional Plays, Rocky Mountain Region: Rocky Mountain Association of Geologists.
  - This publication is available on the RMAG website: <http://www.rmag.org/hydrocarbon-source-rocks>
- Two project-related presentations were given at the AAPG Rocky Mountain and Pacific Section meeting, held in Las Vegas, Nevada, in early October 2016.
  - Rueda, F. (U. of Alberta), Vanden Berg, M.D., and Machel, H.G. (U. of Alberta) – Origin of Petroliferous Dolomitic Beds in the Uteland Butte Member, Lower Green River Formation, Uinta Basin, Utah.
  - Birdwell, J.E. (USGS), Vanden Berg, M.D., Johnson, R.C. (USGS), and Boehlke, A.R. (USGS) – Geochemistry and Mineralogy of the Uteland Butte Member of the Green River Formation, Uinta Basin, Utah.
- One project-related abstract was accepted for presentation at the AAPG ACE Meeting, to be held in Houston, Texas, in early April 2017.
  - Birdwell, J.E. (USGS), Vanden Berg, M.D., and Johnson, R.C. (USGS) – Geochemistry and Mineralogy of the Eocene Green River Formation Petroleum System, Uinta Basin, Utah.

### **Tasks 3.0 and 4.0: Data Compilation and Core-Based Geologic Analysis**

**Uteland Butte member:** Various projects are still underway on the Uinta Basin portion of the project. Our collaboration with U.S. Geological Survey (USGS) is ongoing. Recently, USGS researchers extensively sampled several Uteland Butte cores for detailed mineralogy and organic geochemistry analyses (the subject of a poster presentation at the 2017 AAPG meeting). Research at the University of Alberta is also ongoing, including detailed thin section petrography, mineralogy, and isotope geochemistry, all focused on deciphering the origins of the dolomites within the Uteland Butte. Over the duration of the no-cost extension, the PI will work to finalize all core descriptions, regional mapping, and facies analyses and synthesize collaborator research into a comprehensive final report.

**Cane Creek shale:** Research on the Cane Creek shale in the Paradox Basin is essentially finished and the focus has shifted to preparing a comprehensive final report.

### **Task 5.0: Outcrop Examination and Characterization – Uinta Basin**

Research related to Task 5 is finished and culminated in a publication released in August 2016 (UGS Open-Field Report 652).

### **Task 6.0: Well Completion Optimization**

Research is ongoing and will continue throughout the no-cost extension.

## **CONCLUSION**

The project is currently only three months away from the March 31, 2017 completion date. The recent 6-month no-cost extension was needed to give graduate students working on the project more time to finish their theses. The PI and other UGS geologists are currently finalizing research tasks and synthesizing collaborator research into a comprehensive final report. In addition, several project team members continue to share their results at regional and national meetings.

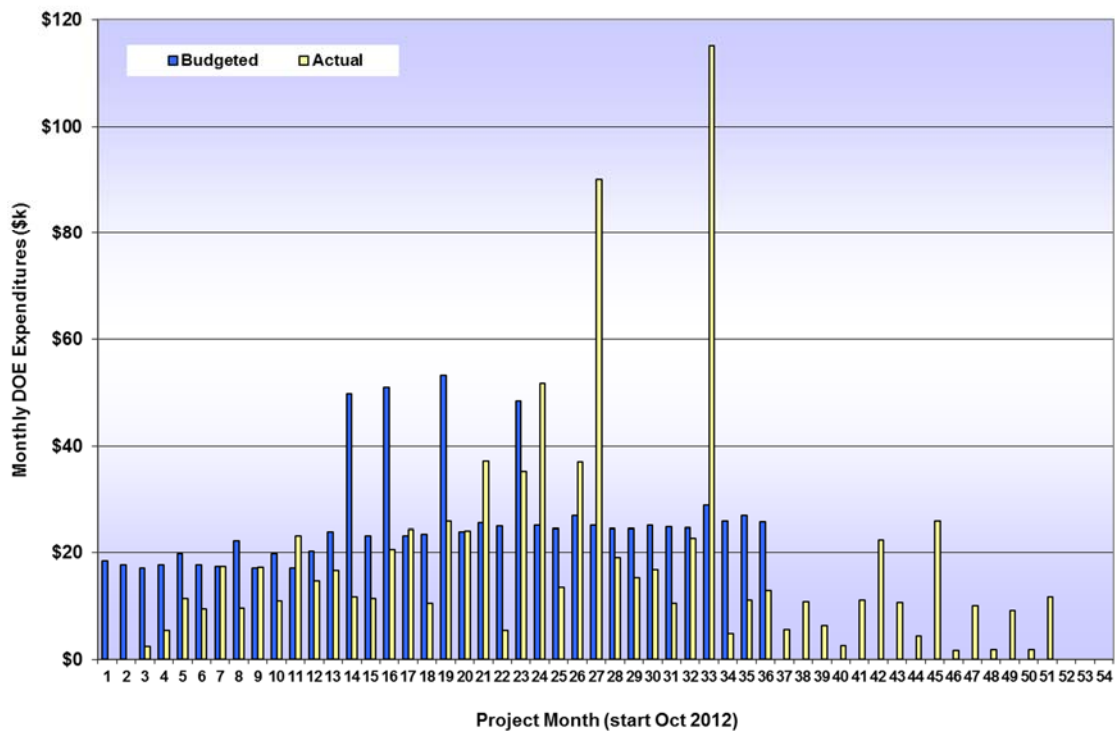
## COST STATUS

*Table 1. Project costing profile for 1.5-year no-cost extension.*

	Oct 2016		Nov 2016		Dec 2016	
	Plan	Actual	Plan	Actual	Plan	Actual
UGS-personnel		\$5,832		\$1,411		\$8,057
Travel Expenses <sup>1</sup>		\$904		-\$15		
Analyses						
Miscellaneous <sup>2</sup>						\$77
<b>SUBTOTALS</b>		\$6,735		\$1,397		\$8,133
<b>UGS OVERHEAD (34.44%)</b>		\$2,320		\$481		\$2,801
<b>SUBCONTRACTS</b>						
EGI						\$701
Eby						
CSM						
EGI - Moore						
U. of Alberta						
<b>GRAND TOTALS</b>		\$9,055		\$1,878		\$11,636

<sup>1</sup>Oct/Nov – AAPG-RMS/PS in Las Vegas

<sup>2</sup>Dec – Rock cutting blade and supplies



*Figure 1. Project costing profile.*

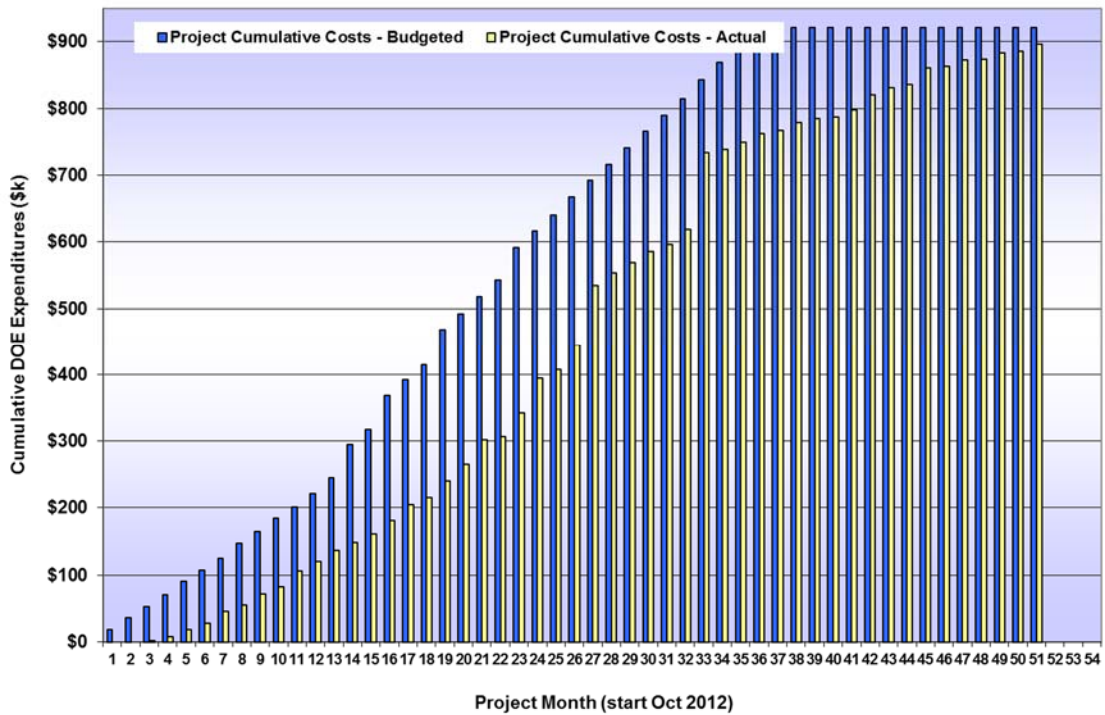


Figure 2. Project cumulative costs.

## MILESTONE STATUS

Table 2. Milestone log for 1.5-year no-cost extension

	Title	Related task or subtask	Completion Date	Update/comments
Milestone 32	Quarterly updates of website	Subtask 2.1	Quarterly	Ongoing, 1.5-year extension
Milestone 33	Quarterly reports	Subtask 2.2	Quarterly	Ongoing, 1.5-year extension
Milestone 34	Profiles of mechanical stratigraphy	Subtask 6.5	31-Mar-15	Ongoing, 1.5-year extension
Milestone 35	Regional correlation and mapping	Subtask 7.1	31-Mar-15	Ongoing, 1.5-year extension
Milestone 36	Regional cross sections	Subtask 7.2	31-Mar-15	Ongoing, 1.5-year extension
Milestone 37	Sweet spot maps	Subtask 7.3	31-Mar-15	Ongoing, 1.5-year extension
Milestone 38	Technical presentations at National AAPG	Subtask 2.4 & 5	Apr-15	1 abstract accepted to AAPG 2017 (early April)
Milestone 39	Core workshop and/or field trip	Subtask 2.7	Jul-15	Core workshop was held on January 30-31, 2017
Milestone 40	Locating completions	Subtask 6.4	30-Sep-15	Ongoing, 1.5-year extension
Milestone 41	Stimulation diagnostics modeling	Subtask 6.6	30-Sep-15	Ongoing, 1.5-year extension
Milestone 42	Reservoir simulations/stimulation locating	Subtask 6.7	30-Sep-15	Ongoing, 1.5-year extension
Milestone 43	Final publications	Subtask 2.6	30-Sep-15	Due 90-days post end of project
Milestone 44	Final interpretation	Task 8	30-Sep-15	Due 90-days post end of project

## ACCOMPLISHMENTS

- New publication:
  - Birdwell, J., Vanden Berg, M.D., Johnson, R.C., Mercier, T.J., Boehlke, A.R., and Brownfield, M.E., 2016, Geological, Geochemical, and Reservoir Characterization of the Uteland Butte Member of the Green River Formation, Uinta Basin, Utah, *in* Dolan, M.P., Higley, D.K., and Lillis, P.G., editors, Hydrocarbon Source Rocks in Unconventional Plays, Rocky Mountain Region: Rocky Mountain Association of Geologists.
    - <http://www.rmag.org/hydrocarbon-source-rocks>
- “In-press” publication, should be available March 2017:
  - Chidsey, T.C., and Eby, D.E., in press, Potential Oil-Prone Areas in the Cane Creek Shale Play, Paradox Basin, Utah, Identified by Epifluorescence Microscopy Techniques: UGS Special Study 160.
- Two project-related presentations were given at the AAPG Rocky Mountain and Pacific Section meeting, held in Las Vegas, Nevada, in early October 2016.
  - Rueda, F. (U. of Alberta), Vanden Berg, M.D., and Machel, H.G. (U. of Alberta) – Origin of Petroliferous Dolomitic Beds in the Uteland Butte Member, Lower Green River Formation, Uinta Basin, Utah.
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## PROBLEMS OR DELAYS

The project is halfway through a 6-month extension, and has a project ending date of March 31, 2017. This second and final extension is mostly to give graduate students working on the project enough time to finish and publish their research. The PI did not project expenditures for each month of the two extensions, but sufficient funds remain to support the project through March 2017. The project is currently 97.3% of total budget.

## PRODUCTS AND TECHNOLOGY TRANSFER ACTIVITIES

- Project website:
  - The project website has been updated with new reports, publications, and abstracts.
  - [http://geology.utah.gov/emp/shale\\_oil](http://geology.utah.gov/emp/shale_oil)
- Quarterly Report:
  - July to September 2016
  - Completed late October and is available on the project website.
- Publication:
  - Birdwell, J., Vanden Berg, M.D., Johnson, R.C., Mercier, T.J., Boehlke, A.R., and Brownfield, M.E., 2016, Geological, Geochemical, and Reservoir Characterization of the Uteland Butte Member of the Green River Formation, Uinta Basin, Utah, *in* Dolan, M.P., Higley, D.K., and Lillis, P.G., editors, Hydrocarbon Source Rocks in Unconventional Plays, Rocky Mountain Region: Rocky Mountain Association of Geologists.

- This publication is available on the RMAG website: <http://www.rmag.org/hydrocarbon-source-rocks>
- Presentations:
  - Two project-related oral presentations were given at the AAPG Rocky Mountain and Pacific Section meeting, held in Las Vegas, Nevada, in early October 2016.
    - Rueda, F. (U. of Alberta), Vanden Berg, M.D., and Machel, H.G. (U. of Alberta) – Origin of Petroliferous Dolomitic Beds in the Uteland Butte Member, Lower Green River Formation, Uinta Basin, Utah.
    - Birdwell, J.E. (USGS), Vanden Berg, M.D., Johnson, R.C. (USGS), and Boehlke, A.R. (USGS) – Geochemistry and Mineralogy of the Uteland Butte Member of the Green River Formation, Uinta Basin, Utah.
- Abstract:
  - One project-related abstract was accepted for presentation at the AAPG ACE Meeting, to be held in Houston, Texas, April 2-5, 2017.
    - Birdwell, J.E. (USGS), Vanden Berg, M.D., and Johnson, R.C. (USGS) – Geochemistry and mineralogy of the Eocene Green River Formation petroleum system, Uinta Basin, Utah
  - The poster will be presented in the “Unconventional: Plays of the U.S. Lower 48” session on Monday morning, April 3, 2017.
  - The abstract has been posted on the UGS project website.



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