Quarterly Progress Report

Reporting Period: October 1 – December 31, 2014

Cooperative Agreement DE-FE00024297

West Virginia University Research Corporation

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Signature of Submitting Official:_____

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October 1 – December 31, 2014

Executive Summary

The objective of the Marcellus Shale Energy and Environment Laboratory (MSEEL) is to provide a long-term field site to develop and validate new knowledge and technology to improve recovery efficiency and minimize environmental implications of unconventional resource development.

The first quarter of activity on this project has been generally limited to project planning and establishing data sharing infrastructure. The project was awarded on a conditional basis, and development of subawards has been progressing, ahead of definitization of the award.

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Project Performance

This report summarizes the activities of Cooperative Agreement DE-FE0024297 (Marcellus Shale Energy and Environment Laboratory – MSEEL) with the West Virginia University Research Corporation (WVURC) during the first quarter of the FY2015 (October 1 through December 31, 2014).

This report outlines the approach taken, including specific actions by subtopic. If there was no identified activity during the reporting period, the appropriate section is included but without additional information.

Topic 1 – Project Management and Planning

Subtopic 1.1. – Project Management

Approach

The project management team will work to generate timely and accurate reporting, and to maintain project operations, including contracting, reporting, meeting organization, and general oversight.

Results and Discussion

Primary activity this quarter was focused on definitization of the overall project award, including finalization of the project budget, development of the project management plan (PMP), and scheduling of project data collection and planning meetings.

The leadership team has engaged the participants from West Virginia University (WVU), Ohio State University (OSU), Northeast Natural Energy (NNE) and the Natural Energy Technology Laboratory in a three day planning session to prepare for developing the baseline, drilling of the observation well and the production well(s).

Schedule was finalized for drilling of the top holes for the observation well and production wells. Top holes for all three wells will be drilled starting (Spud date) on 7/19/2015. The observation well will spud with the deep rig on 8/25/2015. The production wells will spud on 10/12/2015 and be completed (fracture stimulated) beginning on 11/18/2015. Procedures were developed for each of the research groups to submit sampling plans and requests for the observation well and production wells. We have received a number of requests and are working through the type, amount and frequency of samples. We have had extensive discussions with NNE concerning the subcontractors for the observation and production wells. Given the current economic climate in the petroleum industry, we are in a very good position to receive the highest quality and a reasonable price. We are still working with NNE to finalize subcontractors on the observation and production well. Initial surface site engineering for the observation has just been received. Permitting for all three wells has been initiated.

Budget:

Project budget has been finalized, and is awaiting definitization with remainder of the award. A project spend plan has been provided to NETL. Primary concern is funds availability for vertical science well drilling in spring 2015 (April timeframe).

Project Management Plan:

The first version of the project management plan has been submitted to the NETL project manager. There are still some key additions, including the definition of the data collection plan, and definition of the external and internal advisory committees. Data planning meetings are scheduled for the week of January 12, 2015.

Subcontracting:

Development of subcontracts has been ongoing, but cannot be finalized until the final award, including final terms and conditions, has been received by WVU. Key pieces of concern are Statement of Substantial Involvement and IP terms. The primary reason for concern is due to Northeast Natural Energy (NNE) being new to Federal contracting, and the desire to work through the terms with NNE's legal team at the time of subcontract issuance. It is expected that the award and subcontracts will be finalized in 2QFY15.

Subtopic 1.2. – Database Development

Approach

We will use CKAN, open source data portal software (www.ckan.org). This platform is used by NETL-EDX and Data.gov among other organizations and agencies. We will use this platform to store, manage, publish and find datasets.

Results and Discussion

The data portal was demonstrated and is functional. We have tested it internally and will use it to store and distribute the data for the two previous NNE wells at the site. Once the subcontract with NNE is finalized, we will load the data. Expect the data to be loaded and available to participants by 2/28/2015. We have created a private work space for management documents.

Topic 2 – Geologic Engineering

Approach

The geologic engineering team will work to generate to improve the effectiveness of fracture stage design. Evaluating innovative stage spacing and cluster density practices to optimize recovery efficiency. The team will use a data driven approach to integrate geophysical, fluid flow and mechanical properties logs, microseismic and core data to better to characterize subsurface rock properties, faults and fracture systems to model and identify the best practices for field implementation, and assess potential methods that could enhance shale gas recovery through experimental and numerical studies integrated with the results of the production wells at the MSEEL site.

Results and Discussion

Primary activity this quarter was reviewing and evaluating documents submitted by major well service companies for completion and production well monitoring, including microseismic monitoring from the observation well. In general all bids for services look very favorable with very competitive costs and very high technology. The results will be summarize and presented to the technical committee and NETL-DOE

Products

No products this quarter.

Plan for Next Quarter

Present plan for approval by the technical committee and NETL-DOE for the technology to be deployed. Work to evaluate data and information from two previous production wells.

Topic 3 – Deep Subsurface Rock, Fluids, and Gas

Accomplishments:

The subsurface rock/fluid/gas team met together at the 2014 American Geophysical Union (AGU) Fall Meeting in December 2014 to discuss next steps in the project. At AGU, we hosted a special session on Biogeochemistry of Deep Shale, which had an excellent turnout.

Goal 1: Develop a biological sampling protocol to incorporate into the field plan. Based on our discussions at the AGU meeting, we developed a 2-page summary broadly outlining the types of samples we are requesting from MSEEL, the before-drilling and during-drilling processes that we hope to employ at the site. The summary also outlines the equipment needed

on site (or at WVU) during coring/fluid sampling. The team attended the MSEEL kick-off meetings and brought up several of these points to project leadership. Based on the financial constraints of the project and feedback from the operator, we are currently refining our protocols to identify possible zones for targeting biomass/geochemical and isotope sampling.

Goal 2: Identify possible zones for targeting biomass sampling. Although little progress has been made toward this goal, we are working to gather information from pilot holes and other production wells near the site to identify *a priori* regions with high carbon and/or highly fractured for targeting biological sampling.

Goal 3: Identify and order any specialized equipment and materials for coring to be tested and shipped to WVU. In addition to our sampling protocol to be incorporated into the field plan, we are developing a very specific sampling, handling, and processing protocol that will allow us to track microbial contamination during all aspects of drilling and coring. This will be our working plan throughout this project for separating external microbial signatures from those identified as deep shale signatures and justifying these decisions in future reports/publications. These steps will require specialized laminar flow hoods, grinding equipment, and anaerobic chambers that we will set up temporarily at WVU during field activities. In Jan 2015, the team toured the WVU Geology laboratories and identified possible locations for these equipment.

Goal 4: Test out methods for extracting biomass and biomarkers from core and fluids. The team has made significant progress toward this goal over the past year. Students traveled to the University of Tennessee, Knoxville to train in the Center for Biotechnology on extraction of lipids from samples. We've also experimented with the addition of amendments for improving recovery of biomass. Based on preliminary geochemical and isotope data on samples analyzed, samples were selected from two cores with different thermal maturities and the team found noticeable differences in biosignatures and biomass densities between these cores

Goal 5: Develop methods and protocols for sampling fluids and gases for isotopic, molecular and microbiological analysis: The team is currently in process of talking to NNE and outlining the special sampling equipment needed for sampling fluids and gases at high pressure with minimal exposure to environment. For isotopic and microbiological analysis its essential that water and gas samples are collected near the well-heads before they undergo any type of processing.

Goal 6: Develop liaison between different PI's interested in sub-surface samples: Sharma has been communicating with different research groups at WVU, OSU and NETL interested in obtaining sub-surface samples, the type of analysis they are interested in conducting and their research objectives. Some ideas on various subsurface tasks and the key research objectives were identified and presented at the MSEEL kick-off meeting at NETL Morgantown on November 12.

Training/Professional Development

1 undergraduate student, 2 PhD students and 1 postdoctoral researcher in Sharma's lab have been engaged in discussions on subsurface sampling of core, fluids and gases. They were trained in lab safety protocols and methods for extracting a few biomarkers from shale samples.

Plan for Next Quarter

The team is currently working with the operator (NNE) to determine the most efficient way to deliver agents to track microbial contamination in vertical and sidewall cores. We are also working with NNE to incorporate specialized equipment that can be used collect samples from the wellhead after fracking/completion takes place (i.e. sampling before stagnant holding tanks). At current, we have identified a plan for delivering fluorescent microspheres to coring fluids that

can be used to identify which parts of the core have been contaminated during drilling and handling. With the assistance of NNE, we are working out the following details to estimate the amount of tracer mass and delivery efficiency: 1) drill fluid volumes; 2) drill fluid composition; and 3) equipment specifications in order to design a pump delivery system containing our biological tracer. The team plans to add our tracer, test out its effectiveness on a drill fluid sample in contact with a core, and practice paring the contaminated portions during the next quarter.

The team also plans to hold a 1-day workshop at OSU on Feb 27 where the WVU research group will travel to Columbus to discuss preliminary project data, drilling and sampling plans. The outcome from this workshop will be our completed field/experimental plan for the summer 2015 coring. Plans will also be finalized for experiments that will help us to optimize chemical additives for extracting biomass and running concurrent lipid, genomic DNA, isotope, and geochemical analyses in WVU and OSU labs.

In the WVU laboratory students will get trained on a) protocols for extracting different biomarkers, sulfides and sulfates from shale samples b) running samples for isotopic analysis on gas isotope ratio mass spectrometer coupled to Gas Bench, Elemental analyzer and GC-Isolink. Sharma will also engage in detailed discussions with researchers at NETL, OSU and WVU interested in acquiring sub-surface samples. Sampling strategies, key research questions and data sharing will be streamlined to avoid duplication of research efforts.

Finally, we are working on a second set of experiments extracting and analyzing biomass from outcrop shale as a test for what we will receive during drilling. These experiments will help us to optimize chemical additives for extracting biomass and handling protocols before cores are received. Extractions will be used for testing concurrent lipid, genomic DNA, isotope, and geochemical analyses in WVU and OSU labs. The details for these optimization experiments are being developed and will be discussed during our February workshop.

Products:

No products this quarter.

Topic 4 – Geophysical and Geomechanical

Accomplishments:

The Geophysical and Geomechanical team participated in site visits to NETL and to NNE's well site in this reporting quarter. Primary activities have been working with NNE on review and selection of the geophysical services proposals, with a focus on key items for logging and microseismic.

Additionally, data and log information from wells in the surrounding area are in the process of collection. The purpose of this data is to provide the background and regional geological framework.

Plan for Next Quarter

The team expects to work closely with NNE on existing well data and logs. This activity is in a hold until subcontracts that establish the data sharing frameworks and the DOE data protections are complete. This is expected in early 2QFY15.

Products:

No products this quarter.

Topic 5 – Surface Environmental

Accomplishments:

1. Review of Existing USEPA Data:

The USEPA Region III office was contacted concerning the Superfund site: Morgantown Industrial Park (a.k.a. Ordnance Works Disposal Areas) to obtain information on the locations of existing monitoring wells and parameters monitored for the site. This Superfund site is located on property near the Northeast Natural Energy (NNE) well pad. According to information obtained from USEPA Region III's website, there are ten monitoring wells currently in existence ranging in depths from 4.5 feet to 120 feet as part of the ongoing monitoring program of the landfill cap system and treatment wetlands. Six wells are considered shallow (12 feet or less in depth) and four wells are considered "deep" (two at 70 foot depths and two at 120 foot depths). All shallow wells were last sampled in 2012. Deep wells were to be sampled in 2014. The Operation and Maintenance Post Closure Plan for this site does not call for sampling to continue after 2014. A site visit is planned to determine if any of these wells are located within our area of concern and will provide an opportunity to monitor impacts from drilling, development, stimulation of either the "science well" or the new gas wells.

Two Resource Conservation and Recovery Act (RCRA) sites were also identified on property adjacent to the Northeast Natural Energy well pad. These RCRA sites are currently listed on USEPA Region III's website as Addivant USA LLC North Plant and Addivant USA LLC South Plant. Originally, these facilities were also part of the Morgantown Ordnance Works site. The South Plant is located downgradient and to the southeast of the NNE well pad in the direction of the Monongahela River. The North Plant is also located between the NNE well pad and the Monongahela River. Both facilities are currently active and possess a network of monitoring/observation wells. Contamination in several of the wells was detected during monitoring activities through 2009 with the more recent contamination results from the North Plant site. It is unknown at this time if groundwater samples are continuing to be collected at either site (North Plant or South Plant). According to available reports, monitoring wells are located within the overburden (estimated depths less than 25 feet), shallow bedrock (estimated depths up to 50 feet), intermediate bedrock (estimated depths up to 90 feet), and deep bedrock (depths up to 160 feet). A site visit will be undertaken to determine whether any of these wells are located within our area of concern. Location and depth of existing monitoring wells, access, and prior contamination events will be evaluated to determine whether any of these wells could be included in baseline environmental characterization and/or continuous monitoring during gas well development activities. If it is determined any of these wells will provide opportunity to monitor groundwater impacts, follow-up with the USEPA to obtain monitoring results will be necessary to obtain complete background data and establish accurate baselines.

2. Design Sampling Plan:

Work was initiated on the development of a sampling plan for surface, groundwater, and aqueous gas development waste streams. An initial list of water quality parameters were identified and quotes obtained from certified laboratories. A draft plan and budget will be provided during the project meetings planned for January.

Training/Professional Development:

1. Although required for all shale gas field projects, WRI field staff obtained SafeLand training during this quarter and is scheduled to take the 8-hour HAZWOPER refresher course in January 2015.

Plan for Next Quarter

1. Determine usefulness of existing monitoring wells located near the Northeast Natural Energy site
2. Finalize Sampling Plan
3. Develop SOPs for field work specific to the surface environmental portion of this project
4. Include health and safety plan in the SOPs

Topic 6 – Economic and Societal

Accomplishments:

The Economic and Societal team participated in site visits to NETL and NNE's well site, and participated in the data management/data needs meeting.

The team discussed possible surveys and related topics with NNE. Follow-up email initiated survey instrument designs. At least two separate surveys will be developed, one to focus on macro-level (company/contractor) activity and one on micro-level (labor characteristics and expenditures behavior).

The team met with WVU stakeholders in the School of Public Policy and School of Public Health to discuss collaboration and participation in survey activies.

Plan for Next Quarter

The team intends to seek Institutional Review Board (IRB) approval for survey instruments, and initiate the surveys.

Products:

No products this quarter.

Cost Status

Project Title: Marcellus Shale Energy and Environment Laboratory at West Virginia University

DOE Award Number: DE-FE0024297

Year 1

Start: 10/01/2014 End: 09/30/2015

Baseline Reporting Quarter	Q1 (12/31/14)	Q2 (3/30/15)
Baseline Cost Plan	(From 424A, Sec. D)	
(from SF-424A)		
Federal Share	$549,000	
Non-Federal Share	$0.00	
Total Planned (Federal and Non-Federal)	$549,000	
Cumulative Baseline Costs		
Actual Incurred Costs		
Federal Share	$0.00	
Non-Federal Share	$0.00	
Total Incurred Costs - Quarterly (Federal and Non-Federal)	$0.00	
Cumulative Incurred Costs	$0.00	
Uncosted		
Federal Share	$549,000	
Non-Federal Share	$0.00	
Total Uncosted - Quarterly (Federal and Non-Federal)	$549,000	