

# Oil & Natural Gas Technology

DOE Award No.: DE-FE0024297

## Quarterly Research Performance Progress Report

(Period ending: 3/31/2015)

### Marcellus Shale Energy and Environment Laboratory (MSEEL)

Project Period: October 1, 2014 – September 30, 2019

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

April 30, 2015



Office of Fossil Energy

# **Quarterly Progress Report**

January 1 – March 31, 2015

## **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 second quarter of activity on this project has been generally limited to project planning and establishing data sharing infrastructure. Several meetings with the technical teams to establish data requirements have been held, and are expected to continue into the next reporting quarter. Meetings to date include a review of available pre-existing data from the first well (outside of this project) at the MIP site, a safety and site access overview, air and noise monitoring plan and data requirements, and water sampling plan and data requirements. The project has established the subaward with Northeast Natural Energy, and is in process of negotiating the subaward with Ohio State. Funds limitation is a concern, as heavy drilling activity is planned in the next quarter. Project team is working closely with DOE to manage this issue.

# Quarterly Progress Report

January 1 – March 31, 2015

## 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 second quarter of the FY2015 (January 1 through March 31, 2015).

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**

The MSEEL team met on a weekly basis with service companies to discuss various aspects (Wednesdays at 2:30PM, except 4/1 at 3:30PM). Table 1 is the schedule for the first and second quarters.

#### **NNE Weekly Meeting Scheduled at 2:30PM except 4/1**

Date	Topic	Leaders
3/11/2015	Old Data	Carr, Sharma, Ziemkiewicz
3/18/2015	Safety	Representative of each group that will be on site.
3/25/2015	Air and Noise monitoring	McCawley et al.
4/1/2015	Water Sampling 3:30	Paul Ziemkiewicz, Shikha Sharma et al.
4/8/2015	Coring	
4/15/2015	Logging	
4/22/2015	Micro seismic	
4/29/2015	Fiber	
5/6/2015	Drilling services	
5/13/2015	Completion services	

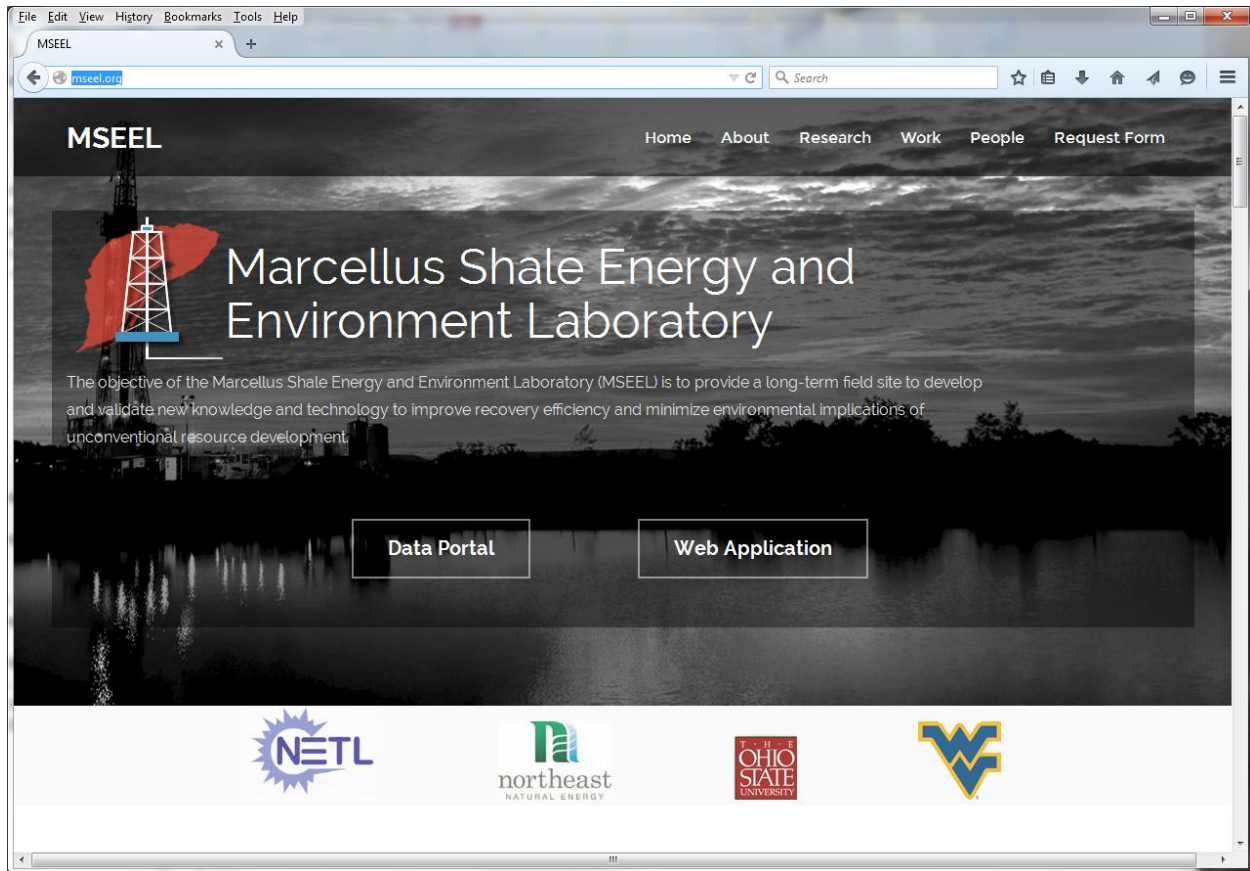
### Subtopic 1.2. – Database Development

#### **Approach**

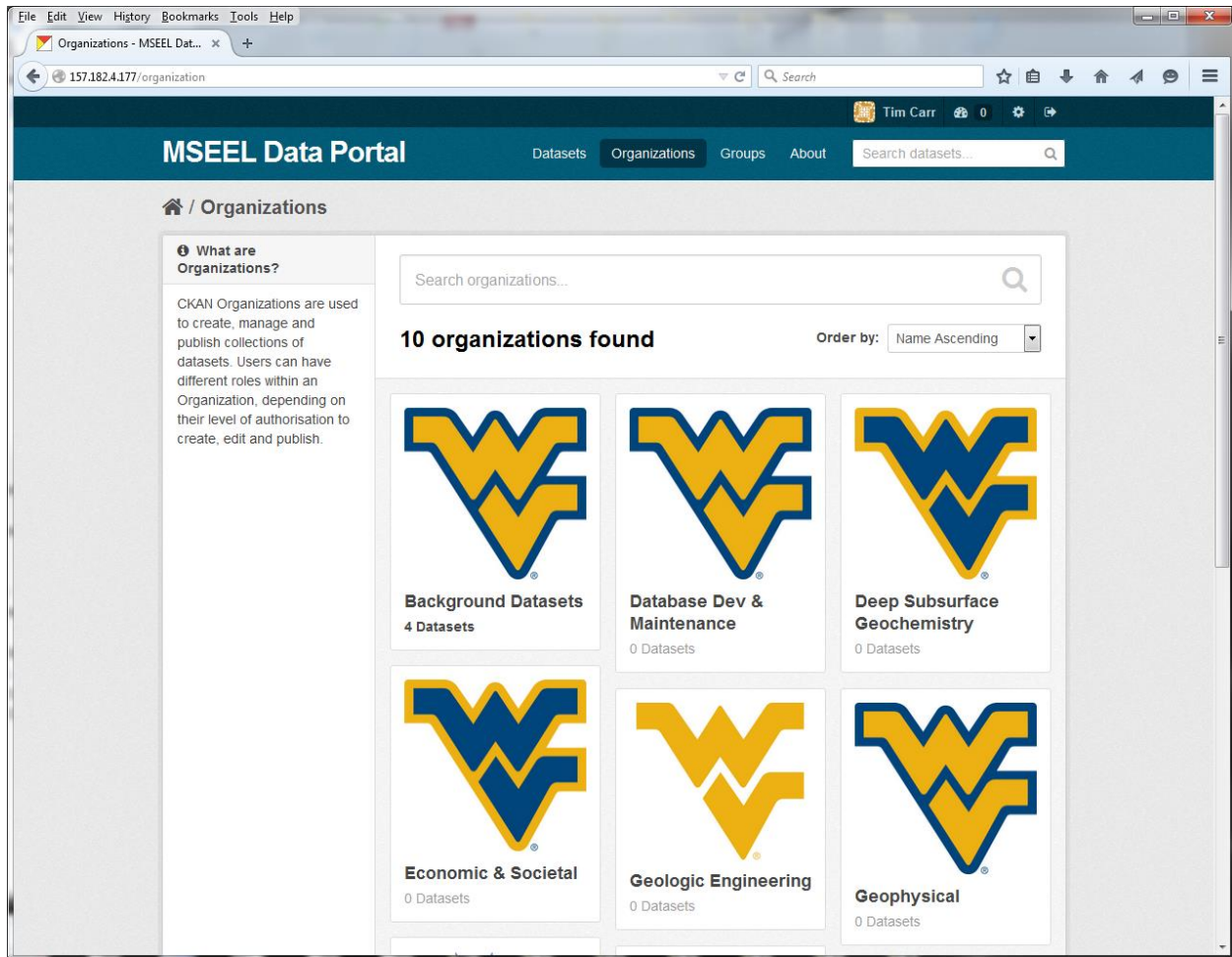
We will use CKAN, open source data portal software ([www.ckan.org](http://www.ckan.org)). This platform is used by NETL-EDX and Data.gov among other organizations and agencies. We will use this platform to store, manage, publish and find datasets.

#### **Results and Discussion**

The MSEEL web site (<http://www.mseel.org>) is operational (Figure 1) and leads to a MSEEL Data Portal (Figure 2). We have begun to add material to both the web page and to the MSEEL Data Portal. The intent of the web page is to be the face of the the MSEEL project to the general public, while the portal is to exchange data among MSEEL research personnel. We have added a number of data sets to the portal including information for the two existing wells that Northeast Natural Energy drill at the MIP well pad.



**Figure 1. – Introduction page to the Marcellus Shale Energy and Environment Laboratory (MSEEL) web site at <http://www.mseel.org>. The MSEEL web site contains basic information for the general public and other interested parties on the project and provides an entrance to the MSEEL Data Portal (Figure 2).**



**Figure 2. – MSEEL Data Portal provides access to approved MSEEL research personnel to data and other information. Data Portal requires a password to access private data sets. Public data can be downloaded by the general public.**

## **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**

The team has been involved in development of protocols for sample collection and data analysis from the science well. In addition, the data from the existing horizontal wells at the site has been

obtained. The analysis of the available data from the existing horizontal wells has been initiated to establish subsurface baseline information.

### **Products**

None this quarter.

### **Plan for Next Quarter**

The team will continue the development of the sample/data collection protocols. The analysis of the available data from the existing wells will continue.

## **Topic 3 – Deep Subsurface Rock, Fluids, and Gas**

### **Approach**

The “Deep Subsurface Rock, Fluids & Gas” team will be responsible for high resolution temporal and/or spatial characterization of the core, produced fluids, and produced gases. The team will use whole and sidewall core and geophysical logs from the science well to conduct various petrophysical analyses to analyze physical rock properties. Data generated by all team members will be integrated to answer following key research questions: 1) geological controls on microbial distribution, diversity and function and how it can effect gas productivity, potential for fracture and pore clogging, well infrastructure and souring 2) major controls on distribution/source/type of organic matter that has implications for oil vs gas production, frackability, restimulation and porosity/permeability effects 3) what are spatiotemporal variations in elemental, isotopic, mineralogical and petrological properties that control presence, geological migration, and modern flow of fluids, water, gases and microorganisms and also effect long-term production behavior of reservoir 4) what are possible water-rock-microbial interactions as a result of injection of fracturing fluids, and 5) does hydraulic fracturing create new pathways for fluid/gas migration

Plan is to develop specific methodology for testing during the next quarter, so that all scientific objectives can be achieved.

### **Results and Discussion**

#### Accomplishments:

Sharma, Mouser, Wrighton and others from OSU research group developed detailed sidewall core, vertical core, and fluid sample sidewall requests for MSEEL and submitted these to Tim Carr and NNE. In addition, our rock/fluid/gas team met together at Ohio State University on February 27 for a workshop to summarize research progress to date. Each group led a 45 minute updates on their research, and the workshop culminated in a discussion of the sampling constraints at MSEEL.

#### Major goals – progress towards:

**Goal 1: Develop a sampling protocol to incorporate into the field plan:** Sharma (WVU) and Daly (OSU representative) have attended weekly MSEEL meetings between WVU, NNE, contractors, and collaborators. We have identified the equipment needed on site for sidewall coring and fluid sampling. We are still refining sampling, handling, and processing protocol that will allow us to track microbial contamination during all aspects of drilling and coring. Based on

conversations with NNE and Baker, we plan on using fluorescent microspheres for a tracer in the sidewall drilling/coring fluids. This information is being incorporated into a detailed field plan.

**Goal 2: Identify and order any specialized equipment and materials:** OSU research group has identified two freezers (-80C and -20C) to be purchased on the project and are awaiting purchasing approval to order dedicated storage equipment. Sharma research group has identified the supplies and cylinders needed to sample fluids and gases for stable isotope analysis.

**Goal 3: Test out methods for extracting biomass and biomarkers from core and fluids:** Methods testing is ongoing. Major progress includes new protocols for DNA extraction and the use of specialized solvents and spikes for lipid biomass extractions. Larger experiments are planned to test these protocols in early May. Methods are being developed in Sharma's isotope lab at WVU to isolate maturity and lipid biomarkers from old cores. We have had significant success in getting good yields from these shale cores. We are currently working to develop GC-MS methods to identify and quantify biomarkers

**Goal 4: Develop methods and protocols for sampling fluids and gases for isotopic, molecular and microbiological analysis:** We have identified the sampling location for sampling fluids and gases from production well at MSEEL. The water samples will be collected right after the separator with minimal exposure to atmosphere and natural gas samples directly from well-heads

**Goal 5: 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.

**Goal 6: High resolution characterization of vertical core in collaboration with NETL:** Sharma and Crandall submitted a funding proposal to ORD by for high resolution multi sensor logging/imaging and SRA analysis of vertical core.

#### Training/Professional Development

Several students and researchers that have been engaged in discussions on subsurface sampling of core, fluids and gases. Students in Sharma lab were also engaged in developing methods on isotope ratio mass spec and GC-MS for bulk isotopes and identification of biomarkers from shale samples. The total number of trainees include

1 undergraduate, 1 MS, 2 PhD students and 1 laboratory manger in Sharma's Isotope lab at WVU

3 MS, 1 PhD and 2 laboratory managers at Mouser, Wrighton, Wilkins labs at OSU

#### **Products**

None this quarter.

#### **Plan for Next Quarter**

Our group plans to meet with drilling company representatives at drilling site to better understand and assess sidewall coring equipment to be used at MSEEL. We continue to work with NNE to determine details for estimating the amount of tracer mass and delivery efficiency in sidewall cores and to determine how to sample high pressure fluids from the flowback pipelines.

In Sharma's laboratory at WVU students will continue to 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.

Plan is to develop specific methodology for testing during the next quarter, so that all scientific objectives can be achieved.

#### **Topic 4 – Geophysical and Geomechanical**

##### **Approach**

Team will conduct microseismic analyses during the frac jobs of the production wells and tie that data back to the geophysical logs obtained from the science well, providing a clearer picture of proppant placement through the establishment of a detailed rock velocity model. Some inferences toward fracture quantity and patterns will also be vetted.

Plan is to identify specific methodology to obtain the data that will provide most understanding of subsurface rock model

##### **Results and Discussion**

No activity this quarter.

##### **Products**

No activity this quarter.

##### **Plan for Next Quarter**

Plan to begin analysis of existing well data at MIP site ahead of planned drilling activities in 4QFY2015.

#### **Topic 5 – Surface Environmental**

##### **Approach**

##### **Results and Discussion**

###### 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 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 east to southeast of the Northeast Natural Energy well pad moving towards the Monongahela River. The North Plant is located north of the well pad. 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). The site visit planned will also determine if any of these wells are located within our area of concern. Location and depth of existing monitoring wells, access, and prior contamination events are some of the concerns to evaluate if any of these wells are to be included in determining 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.

A visit to the site occurred during this quarter to locate existing water wells that may be sampled prior to and during the development of the new gas wells. Property owners do not want any additional wells drilled for groundwater monitoring purposes. Initial contact was made with through a third party with the current water/wastewater treatment operator of the North and South Plants. Based on the third party’s knowledge, wells on location at the North and South Plants are still being monitored and that data may be shared with the WVU team.

## 2. Design Sampling Plan:

Work was initiated on the development of a sampling plan for surface, groundwater, and aqueous gas development waste streams by the WVU team. A list of water quality parameters was identified and a draft sampling plan and budget was shared with the MSEEL team during the project meetings held mid-January.

Additional sampling requests were submitted by various WVU team members along with some external entities. The Project PI made a first attempt to develop a combined sampling schedule that would meet all concerned parties’ needs.

It was determined during the surface sampling meeting held between WVU and NNE, NNE representatives would collect gas development water and waste stream samples with WRI personnel observing from a safe distance. Samples would then be handed over to the WRI personnel and prepared for analyses. NNE representatives will need to be part of the COC for all samples they collect.

Air sampling plan was proposed that would set up a series for stations surrounding the MSEEL location. Stations are located on site and at ½ mile positions up to 2.5 miles from the MSEEL site. The stations would monitor air quality before, during and after operations and include data

on particulate matter (PM 0/1 and PM 2.5), VOCs, Noise, etc.) and also metrological and traffic conditions.

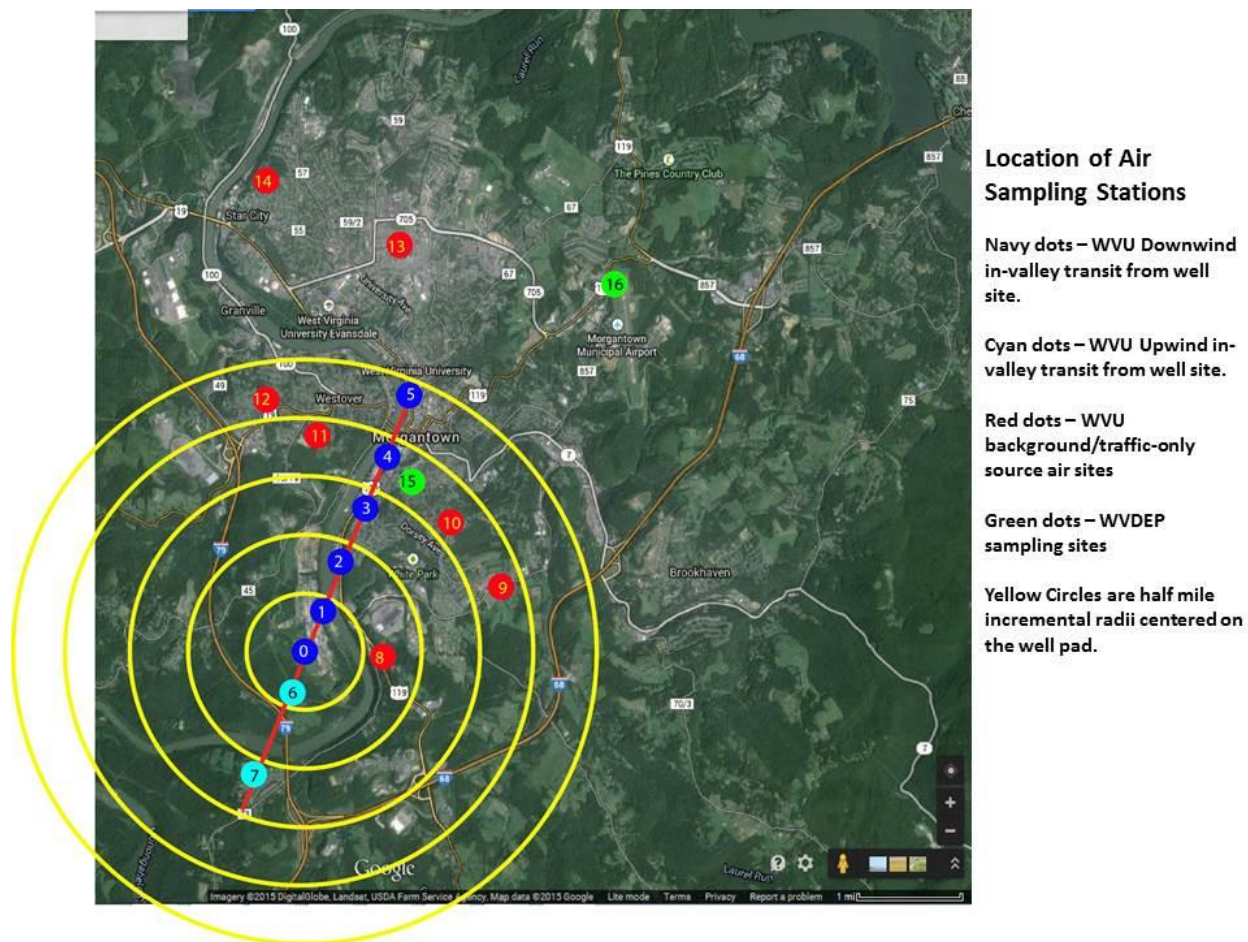


Figure 3. – Location of MSEEL air monitoring stations surrounding the MSEEL site at point zero.

#### Training/Professional Development:

WRI field staff completed the 8-hour HAZWOPER refresher course in January 2015 and attended NNE mandatory health and safety meeting. WRI personnel provided Project PI and NNE with copies of training certifications.

#### **Products**

None this quarter.

#### **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**

### **Approach**

The lead on the political and societal project will work to identify and evaluate the factors shaping the policymaking response of local political actors. Included in this assessment will be an accounting, past and present, of the actions of public and private individuals and groups acting in favor of or opposed to shale gas drilling at the MSEEL site.

First year activity includes developing, distributing, collecting and compiling the responses from a worker survey and a vendor survey. The worker survey will address job characteristics and offsite expenditures. The vendor survey will help to identify per-well cost structures.

### **Results and Discussion**

Worked with NNE to finalize survey questions, and developed a project logo for TShirts to be given to survey respondents.

### **Products**

Survey instrument for workers on the MSEEL project has been developed. The survey is attached as appendix 1.

Logo has been finalized and approved by WVU for intended use.

### **Plan for Next Quarter**

In the next quarter, the lead on the political and societal project will continue to explore the historical and current factors and actors that have shaped or are continuing to shape the policymaking response of local government officials. The lead will also establish a baseline of community opinion and perception of unconventional hydrocarbon resource development at the MSEEL site through interviews of key actors and analysis of newspaper articles and government documents.

## 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)

<u>Baseline Cost Plan</u>	(From 424A, Sec. D)	
(from SF-424A)		
Federal Share	\$549,000	\$549,000
Non-Federal Share	\$0.00	\$0.00
Total Planned (Federal and Non-Federal)	\$549,000	\$549,000
Cumulative Baseline Costs		
<u>Actual Incurred Costs</u>		
Federal Share	\$0.00	\$14,760.39
Non-Federal Share	\$0.00	\$0.00
Total Incurred Costs - Quarterly (Federal and Non-Federal)	\$0.00	\$14,760.39
Cumulative Incurred Costs	\$0.00	\$14,760.39
<u>Uncosted</u>		
Federal Share	\$549,000	\$534,239.61
Non-Federal Share	\$0.00	\$0.00
Total Uncosted - Quarterly (Federal and Non-Federal)	\$549,000	\$534,239.61

## Appendix 1: MSEEL Worked Questionnaire

### MSEEL Science Well Questionnaire

Responses will not be associated with individual names; information will be kept confidential to the fullest extent possible.

#### Worker Background and Experience:

What is your occupation \_\_\_\_\_ [E.g., motor man, scrub hand, etc.]

How many years have you worked in the oil and gas sector? \_\_\_\_\_

How long have you been working in the Appalachian Area? \_\_\_\_\_

On average, how much time do you spend on each job site? \_\_\_\_\_

In the past year, when on a job, what was your average commute time to the job site?  
\_\_\_\_\_ (in minutes)

#### Local Interactions

When on a job away from home, does staying in the city/town give you a sense of community or feeling of belonging? \_\_\_\_\_ (yes/no)

When on a job away from home, do you feel the local residents are mostly welcoming, mostly unwelcoming, or neither? \_\_\_\_\_

#### Economic Information

When you are on a job away from home, do you stay at a hotel, motel? (yes/no)

If no, please describe your lodging arrangements.

When you are on a job away from home, what would be your average weekly expenses on the following:

Lodging/Accommodations \$ \_\_\_\_\_

Private transportation (e.g., vehicle fuel, oil, other --specify) \$ \_\_\_\_\_

Public transportation \$ \_\_\_\_\_ (if used to travel to and from job site)

Clothing \$ \_\_\_\_\_

Food: Groceries \$ \_\_\_\_\_

Food: Prepared food \$ \_\_\_\_\_ (Restaurants, fast food, sandwiches,  
coffee, etc)

Entertainment \$ \_\_\_\_\_ (Movies, bars, public events)

Other (please identify) \$ \_\_\_\_\_

### Personal information

Male \_\_\_\_ Female \_\_\_\_ Age \_\_\_\_

Are you of Hispanic, Latino, or Spanish origin? (Yes/No)

Are you (Select as many as apply)

White? \_\_\_\_

Black or African American? \_\_\_\_

Asian or Asian American? \_\_\_\_

Other? \_\_\_\_

Prefer not to identify \_\_\_\_

Highest level of education (check one)

High School \_\_\_\_

Some College Education or Associates Degree \_\_\_\_

Bachelors Degree \_\_\_\_

Advanced Degree \_\_\_\_

Do you consider yourself a Republican, Democrat, or Independent? (Circle one)

Are you currently married, separated, divorced, widowed, or have you never married?

(Circle one)

When on a job away from home, does your family travel with you? (Yes/No/NA)

In what city and state is your permanent residence? \_\_\_\_\_

**Annual Earnings in \$1,000s**

Less than 50 _____	50 to 60 _____
60 to 70 _____	70 to 80 _____
80 to 90 _____	90 to 100 _____
100 to 120 _____	120 to 140 _____
140 to 150 _____	More than 150 _____

Paid ( hourly / salary )



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