


## RESEARCH PERFORMANCE PROGRESS REPORT

### 1. COVER PAGE DATA ELEMENTS: Mandatory

Federal Agency and Organization Element to Which Report is Submitted	U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL)
Federal Grant or Other Identifying Number Assigned by Agency	DE-FE0029085
Project Title	Long-Term Methane Emissions Rate Quantification and Alert System for Natural Gas Storage Wells and Fields
PI Name, Title and Contact Information	Ann P. Smith, Vice President apsmith@gsi-net.com; 512.346.4474
Submission Date	31 October 2018
DUNS Number	181780776
Recipient Organization	GSI Environmental Inc. 9600 Great Hills Trail, Suite 350E Austin, Texas 78759
Project Period	October 1, 2016 to May 31, 2019
Reporting Period End Date	September 30, 2018
Report Term or Frequency	Quarterly
Signature of Submitting Official	

### 2. ACCOMPLISHMENTS: Mandatory

#### a) What are the major goals of the project?

The primary goal of the project is to employ a novel combination of complementary measurement methods and technologies to detect and accurately quantify average annual methane emissions from underground natural gas storage facilities, including from above-ground equipment leaks plus seepage at the ground surface from underground leaks.

#### b) What was accomplished under these goals?

All project goals for the fourth quarter (Q4) reporting period of July – September 2018 were met. A summary of the activities performed to achieve project goals during Q4 is included below.

#### High Resolution Subsurface Leak Monitoring

**Soil Heat Data Analysis:** Upon initial review of soil temperature profile data from both wells at Clay Basin, the team observed much higher than expected interference from diurnal temperature variations at the well heads, extending to all monitored depths. Review of current literature and technical publications confirmed that the issue has not been studied previously.

A request was made to DOE NETL to accommodate an update to the project (no change in cost or schedule) to 1) quantify subsurface heat interference to in-ground sensors, and 2) eliminate redundant flux chamber sampling events. This change will ensure completeness and that investigations are thorough and robust for predicting where and when elevated levels of methane emissions are occurring below ground to improve understanding of methane emissions from gas storage wells and satisfy DOE NETL program goals

### **Technology Transfer**

**Stakeholder Meetings:** Input from stakeholder meetings held in prior quarters were considered during project field and data collection activities.

**c) What opportunities for training and professional development has the project provided?**

Cross training, data sharing and collaborative protocol development has occurred among GSI employees, Utah State University and Colorado State University researchers.

Technology transfer activities improve labor skills of participating engineering and scientific companies, and increase managerial education and project efficiency by getting real-time feedback on sampling protocols and data analysis.

**d) How have the results been disseminated to communities of interest?**

Presentations and/or meetings regarding the project have been conducted at multiple events since the beginning of the project. TASC calls were held to update stakeholders on project results and next steps.

**e) What do you plan to do during the next reporting period to accomplish the goals?**

Soil heat monitoring data will continue to be collected through March 2019. Technical analysis of in-ground sensor data will continue during the next quarter.

Additional TASC calls will be scheduled to discuss preliminary results of data analysis and planned future activities.

### **3. PRODUCTS: Mandatory**

**a) Publications, conference papers, and presentations**

**i. Journal publications.**

Papers for 1) emission factor development and 2) high-flow sampling methodology are in preparation for submission to peer-reviewed journals.

**ii. Books or other non-periodical, one-time publications.**

Not Applicable during this reporting period.

**iii. Other publications, conference papers and presentations.**

Not Applicable during this reporting period.

**b) Website(s) or other Internet site(s)**

Not Applicable during this reporting period.

**c) Technologies or techniques**

Not Applicable during this reporting period.

**d) Inventions, patent applications, and/or licenses**

Not Applicable during this reporting period.

**e) Other products**

Not Applicable during this reporting period.

**4. PARTICIPANTS & OTHER COLLABORATING ORGNIZATIONS: Optional**

**a) What individuals have worked on the project?**

<b>Name:</b>	Richard L. Bowers
<b>Project Role:</b>	Co-Principal Investigator
<b>Nearest Person Month Worked:</b>	0.2
<b>Contribution to the Project:</b>	Project ccoordination; Data analysis and reporting
<b>Funding Support</b>	None
<b>Collaborated with individual in foreign country:</b>	No
<b>Traveled to foreign country:</b>	No
<b>Name:</b>	Ann P. Smith
<b>Project Role:</b>	Principal Investigator
<b>Nearest Person Month Worked:</b>	0.1
<b>Contribution to the Project:</b>	Project ccoordination
<b>Funding Support</b>	None
<b>Collaborated with individual in foreign country:</b>	No
<b>Traveled to foreign country:</b>	No

**b) What other organizations have been involved as partners?**

<b>Organization Name:</b>	Utah State University
<b>Location of Organization:</b>	Vernal, Utah
<b>Partner's contribution to the project:</b>	Data analysis and reporting
<b>Financial Support:</b>	None
<b>In-kind Support:</b>	None

<b>Facilities</b>	Labs at Bingham Research Center, Utah State University, Vernal, UT
<b>Collaborative Research</b>	None
<b>Personnel Exchanges:</b>	None
<b>More detail on partner and contribution:</b>	None

**c) Have other collaborators or contacts been involved?**

Not Applicable during this reporting period.

**5. IMPACT: Optional**

**a) What is the impact on the development of the principal discipline(s) of the project?**

Not applicable during this reporting period.

**b) What is the impact on other disciplines?**

Not applicable during this reporting period.

**c) What is the impact on the development of human resources?**

Not applicable during this reporting period.

**d) What is the impact on physical, institutional, and information resources that form infrastructure?**

Not applicable during this reporting period.

**e) What is the impact on technology transfer?**

Technology transfer is being performed throughout the project via TASC meetings, focused group meetings with team members and operators, conferences and workshops. These technology transfer activities improve labor skills of participating engineering and scientific companies, and increase managerial education and project efficiency by getting real-time feedback on sampling protocols and data analysis.

**f) What is the impact on society beyond science and technology?**

Better understanding of air emissions sources reduces environmental impacts and minimizes product loss to the industry. Conversations with the EPA on preliminary emission factors calculated for gas storage well components will provide value to their GHGRP.

**g) What dollar amount of the award's budget is being spent in foreign country(ies)?**

None.

## **6. CHANGES/PROBLEMS: Mandatory**

### **a) Changes in approach and reasons for change**

Not applicable during this reporting period.

### **b) Actual or anticipated problems or delays and actions or plans to resolve them**

Not applicable during this reporting period.

### **c) Changes that have a significant impact on expenditures**

No cost overruns are currently anticipated due to current activities and ongoing discussions with DOE NETL regarding scope change activities.

### **d) Significant changes in use or care of human subjects, vertebrate animals, and/or Biohazards**

Not applicable to this Award.

### **e) Change of primary performance site location from that originally proposed**

Not applicable during this reporting period.

## **7. SPECIAL REPORTING REQUIREMENTS: Mandatory**

Not applicable during this reporting period.

## **8. BUDGETARY INFORMATION: Mandatory**

A Cost Status Report is included as Attachment 1. Graphs depicting the status of the budgeted versus cumulative costs of the overall project, technical transfer and cost share are included as Attachment 2.

To date, GSI has provided \$553,100 in cost share to the project, more than 167% of the \$330,000 cost share that was initially proposed. GSI will continue to provide additional cost share to DOE with future technical transfer activities.

As discussed in an email dated 02 April, 2018 from GSI to DOE NETL representatives, differences in projected costs compared to actual costs were caused by several factors, including 1) identification of background interference to soil temperature variations being monitored, 2) installation of additional sensors at greater than anticipated depths at two Clay Basin gas storage wells, and 3) work completed earlier than previously scheduled/budgeted.