GTI ENERGY

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DOT PHMSA Public Quarterly Report

Date of Report: 11th Quarterly Report Ending June 30, 2025
Contract Number: 693JK32210004POTA
Prepared for: USDOT PHMSA
Project Title: Advancing Hydrogen Leak Detection and Quantification Technologies Compatible with Hydrogen Blends
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For quarterly period ending: June 30, 2025

1: Items Completed During this Quarterly Period:

Table 1. Payable Milestones Completed This Quarter

Technical and Deliverable Milestone Schedule			
Item #	Task #	Activity/Deliverable	Title
15	8	11th Quarterly Status Report	Submit 11th Quarterly Report
20	6	Field Testing	Perform Field Testing

The 11th Quarterly Status Report, Determining Field Testing Locations and Sensor Development Activities were all accomplished this quarter and were drawn from Attachment #3, Technical and Deliverable Payable Milestone Schedule (in the contract) from the sixth payable milestones. These items were completed during this reporting period and are the corresponding items included on our next invoice.

2: Items Not Completed During this Quarterly Period:

Nothing to report.

3: Project Technical Status:

ACTIVITY: LABORATORY TESTING

Item Title: Complete laboratory testing
Item Number: 10
Task Number: 4

Laboratory testing was completed this quarter for both sensors and instruments

Instrument Testing

At GTI Energy, the second round of laboratory testing on pump-based devices has been completed that involved added bump gas tests in between full-scale testing at the gas mixtures shown in Table 2.

Table 2. Gas Mixtures Used for Laboratory Testing by Hydrogen Percentage

Hydrogen Percentage	Methane Concentration (ppm)	Hydrogen Concentration (ppm)
0%	10	0
	1,000	0
	5,000	0
	25,000	0
	100% Methane	0
5%	9.5	0.5
	950	50
	4,750	250
	23,750	1,250
10%	9	10
	900	100
	4,500	500
	22,500	2,500
20%	8	2
	800	200
	4,000	1,000
	20,000	5,000

Laser testing has also been completed, which entailed two rounds of testing; one with Tedlar bags, and another with a simulated thread leak at low flow rates. The Tedlar bags' widths were also measured to obtain a target path integrated concentration that was expected of each laser device. A full list of the blends used in the Tedlar bags is shown below in Table 3.

Table 3. Methane/Hydrogen blends used for Tedlar bag testing

Mix Total Concentration – H2 Blend %	CH4 PPM	H2 PPM	Balance Gas
0 PPM – 0% H2	0	0	Air
10 PPM – 0% H2	10	0	Air
1000 PPM – 0% H2	1000	0	Air
5000 PPM – 0% H2	5000	0	Air
25000 PPM – 0% H2	25000	0	Air
10 PPM – 5% H2	9.5	0.5	Air
1000 PPM – 5% H2	950	50	Air
5000 PPM – 5% H2	4750	250	Air
25000 PPM – 5% H2	23750	1250	Air

10 PPM – 10% H2	9	1	Air
1000 PPM – 10% H2	900	100	Air
5000 PPM – 10% H2	4500	500	Air
25000 PPM – 10% H2	22500	2500	Air
10 PPM – 20% H2	8	2	Air
1000 PPM – 20% H2	800	200	Air
5000 PPM – 20% H2	4000	1000	Air
25000 PPM – 20% H2	20000	5000	Air

For the simulated thread leak, flow rates of 0.25, 0.5, 0.75, and 1 scfh were tested on both pure methane and a 20% hydrogen blend. Both tests measured peak concentrations at set points consistent for all devices and detection rates when scanning the Tedlar bag or simulated leak site. Data analysis is nearly completed on these tests and will be integrated into the final draft report when finalized.

Sensor Testing

Sensor testing was slightly expanded this quarter to encompass more hydrogen-selective sensors as many of the electrochemical sensors tested in previous quarters had high selectivity but poor performance at high hydrogen levels. The new sensors tested included some in the high range electrochemical, MEMS Pellistor, and Standard Pellistor families. The sensors were exposed to 0-20% hydrogen in a methane blend for 5 minutes and were then re-tested to determine what impact hydrogen had on the sensor's functionality

ACTIVITY: STATISTICAL ANALYSIS

Item Title: Complete Statistical Analysis
Item Number: 22
Task Number: 7

As discussed in the previous quarterly report, many of the laboratory testing on pumped instruments have shown very little within-group variability between pure methane and hydrogen blended tests. Especially above 25000 ppm of combustible gas, there was little evidence seen of any interaction between combustible gas concentration level and relative hydrogen concentration level. Given some of the project team's results to date, more investigation is needed to better discern what the possible causes or impacts could be for full-scale pumped instruments.

Additionally, results from three separate CGI instruments have been somewhat varied in that relative hydrogen concentrations have not consistently been found to significantly impact the maximum proportion of methane detected. This is a phenomenon that will be explored in further depth in the final draft report.

Laser testing data analysis has almost been completed, with some preliminary findings showing that path integrated concentrations were generally steady with laser readings up until higher gas concentrations. For the simulated thread leak, the project team's results indicate that path integrated concentration readings were generally higher for methane-only gases than for tests done with 20% hydrogen blends.

Data analysis will be completed in the following quarter and final findings and conclusions will be integrated into the final report.

ACTIVITY: FIELD TESTING

Item Title: Determine field testing locations
Item Number: 14
Task Number: 6

Field testing was completed this quarter with tests focusing on three main scenarios: above ground meter leaks, below ground leaks, and indoor appliances. The project team used hydrogen injection mixtures of 0, 5, 10, 15, and 20 vol% across three separate field campaigns at training sites. A mixture of devices, both pumped and laser, were used during the campaigns along with a Hi-Flow sampler that confirmed the estimated leak rate at each facility. Data analysis is also ongoing for both laser and pumped instruments and will be completed in the coming months as the final report is shared with PHMSA.

ACTIVITY: FINAL DRAFT REPORT

Item Title: Submit Eleventh Quarterly Status Report
Item Number: 21
Task Number: 8

The project team plans to submit the first version of the final draft report to PHMSA in early Q3 of 2025, allowing time for revisions before the final submission at the conclusion of Q3 2025. The final report contains sections on the literature review and background, laboratory testing, and field testing of the project that have been compiled from previous interim reports. The final report closes with a discussion on possible future sensor package proposals and conclusions gleaned over the course of the project.

ACTIVITY: ELEVENTH QUARTERLY STATUS REPORT

Item Title: Submit Eleventh Quarterly Status Report
Item Number: 15
Task Number: 8

The eleventh quarterly status report (this report) will be completed and submitted to PHMSA's PRIMIS server in both public and internal-facing formats

ACTIVITY: PROJECT MANAGEMENT

Item Title: N/A
Item Number: N/A
Task Number: 8

During this quarter, GTI conducted project scheduling, budgeting, establishment of data management strategies, preparation of reports, and organization of required meetings. And secured further field testing with SoCal Gas.

5: Project Schedule:

The project schedule is shown below in Table 4 with the submittal time of this quarterly report outlined in red.

Table 4. Project Schedule

Task	Description	Q4 2022	Q1 2023	Q2 2023	Q3 2023	Q4 2023	Q1 2024	Q2 2024	Q3 2024	Q4 2024	Q1 2025	Q2 2025	Q3 2025
1	Project Scoping and TAP												
2	Literature Review												
3	Develop Evaluation Plan												
4	Laboratory Tests												
5	Develop New Hydrogen Sensing Schemes												
6	Field Tests												
7	Statistical Analysis and Final Report												
8	Project Management												