DOT PHMSA Public Quarterly Report

Date of Report: 3rd Quarterly Report Ending June 30, 2023
Contract Number: 693JK32210004POTA
Prepared for: USDOT PHMSA
Project Title: Advancing Hydrogen Leak Detection and Quantification Technologies Compatible with Hydrogen Blends
Prepared by: GTI Energy
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For quarterly period ending: June 30, 2023

1: Items Completed During this Quarterly Period:
The Field Evaluation and the 3rd Quarterly Status Report were both completed this quarter and drawn from Attachment #3, Technical and Deliverable Payable Milestone Schedule (in the contract) from the third payable milestone. 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:
This project is currently on schedule.

3: Project Technical Status:

ACTIVITY: TECHNICAL ADVISORY PANEL (TAP)

Item Title: Form Technical Advisory Panel (TAP)
Item Number: 1
Task Number: 1

The project team decided to slightly expand the TAP to include a research engineer from Southwest Research Institute (SwRI) who has been conducting experiments on leak detection technology's efficacy in hydrogen/natural gas blends. With the addition of Swanand Bhagwat, our TAP should now be finalized with the individuals that can be seen in Table 1 below.

Table 1. List of Selected TAP Members

Member	Organization
Robert Smith	US DOT PHMSA /Project Representative
Mary McDaniel	US DOT PHMSA/Technical Task Inspector

Sonal Patni	OTD/Sponsor
Mark Piazza	API/Member
Paul Ohodnicki	Univ. of Pittsburgh/Academic Reviewer
Ruishu Wright	NETL/Member
Tim Harris	Entrust Solution Group/Member
Jo Ellen Scott	Entrust Solution Group/Member
Danielle Mark	PG&E/Member
Ryan Weber	Northwest Natural/Member
Kevin Woo	SoCal Gas/Member
Vineet Aggarwal	Heath Consultants/Member
Swanand Bhagwat	Southwest Research Institute

We held an update meeting for the TAP on April 14th to detail the findings from the literature review across leakage dynamics, existing leak detection methodologies/equipment, and sensing technologies. TAP members were very receptive to the literature review and provided helpful feedback on sensing technologies that guided the construction of our next deliverable, the Evaluation Framework.

ACTIVITY: FIELD EVALUATION

Item Title: Develop and establish laboratory and field evaluation methodologies
Item Number: 5
Task Number: 3

The project team completed the Evaluation Framework which will be used to evaluate the extensive field and laboratory testing that will be setup and accomplished over the coming quarters. Before finalizing the document, the TAP was given an initial draft and was updated on the framework's progress in a call on June 15th.

TAP members provided many insightful comments that helped us recraft the framework into a more meaningful and substantive document that informs the testing. Not every TAP member was able to join, but those that weren't sent replacements in their stead to facilitate discussion. TAP members brought up a variety of relevant topics both at the initial discussion and upon review in the weeks following including:

- Considering the coupled effects of hydrogen in individual sensor testing.
- Incorporating bar hole or soil saturation analysis.
- Separation possibilities between hydrogen and methane on high pressure vs low pressure lines.

- Assessing the effects of hydrogen vs establishing leak survey performance criteria.

Most of these comments helped to inform the final draft of the Laboratory and Field Evaluation Framework. The full document will be submitted to the project page in PHMSA's PRIMIS server under "Technical Reports and Documents", but some highlights from the document have been contained here. The purpose of the report is to provide information on how individual sensors and full instruments will be evaluated on different performance parameters for hydrogen/natural gas blends. The testing is broken down into two types: 1) laboratory testing under controlled conditions, and 2) field testing with controlled leaks at a local distribution company training facility with both underground and above ground leak sources.

The project team identified four distinct major sensor groups of interest: flammable gas sensors, air toxic sensors, oxygen sensors, and hydrogen specific sensors. Each group will require slightly different evaluation protocols and target tests which are discussed in more detail within the report.

The field-based portion of testing will be focused on three main scenarios: above ground meter leaks, below ground leaks, and indoor appliances (e.g., gas stove, water heater, etc.). Hydrogen injection mixtures ranging from 0 to 20 vol.% will be tested dependent on the facility's capabilities. Similarly, leak flow rate will ideally be adjusted from zero to 30 scfh when possible. Data will be logged in a collection table like the one in **Error! Reference source not found.** for later analysis.

Overall, this framework is meant to guide the evaluation of both individual sensors and full instruments with the understanding that any tests identified within the document are subject to modification as necessary. The results obtained during lab and field evaluation will drive the investigation on hydrogen/natural gas blends.

ACTIVITY: THIRD QUARTERLY STATUS REPORT

Item Title: Submit Third Quarterly Status Report
Item Number: 6
Task Number: 8

The third quarterly status report (this report) will be completed and submitted on schedule (on or before June 30th, 2023)

ACTIVITY: PROJECT MANAGEMENT

Item Title: N/A
Item Number: N/A
Task Number: 9

During this quarter, GTI conducted contracting, project scheduling, budgeting, establishment of data management strategies, preparation of reports, and organization of required meetings. Subcontracting with SENSIT Technologies is almost complete.

4: Project Schedule:

The project schedule is shown below in Table 2, with the submittal time of this quarterly report outlined.

Table 2. Project Schedule

Task	Description	1 - Q4 2022	2 - Q1 2023	3 - Q2 2023	4 - Q3 2023	5 - Q4 2023	6 - Q1 2024	7 - Q2 2024	8 - Q3 2024	9 - Q4 2024	10 - Q1 2025	11 - Q2 2025	12 - Q3 2025
1	Project Scoping and TAP												
2	Literature Review												
3	Develop Evaluation Framework												
4	Laboratory Tests												
5	Develop New Hydrogen Sensing Schemes												
6	Field Tests												
7	Statistical Analysis and Final Report												
8	Project Management												