

CAAP Quarterly Report

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Prepared for: *U.S. DOT Pipeline and Hazardous Materials Safety Administration*

Contract Number: 693JK32050005CAAP

Project Title: Improving Pipeline Safety During Gas Leakage Events Using Near Real-Time Data Networks and Optimal Decision-Making Tools

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For quarterly period ending: February 28, 2021

Business and Activity Section

(a) Contract Activity

No proposed contract modifications.

Additional materials purchased include those require to build natural gas detectors. This includes sensors, sensor boards, laboratory supplies (gases for testing, 3D printing supplies), and associated electronics.

(b) Status Update of Past Quarter Activities

In Quarter 2, a PhD student was recruited and will participate in the project, starting in summer 2021. The team will provide PHMSA will updates on the student information as soon as we get their contract in place. We worked towards task 1-3 with the goal of the formation of our advisory committee, completion of the detector design and initial testing and METEC experimental design complete. We met with industry partners and PI Smits presented research at the Pipeline Research Council International (PRCI) 2021 Virtual Research Exchange. Good progress was made in all areas of the project and we are currently on task/schedule. Specifics of each task can be found below.

Presentation:

Smits, K.M., Y. Cho, S. Tian, S. Riddick, B.A. Ulrich and D.J. Zimmerle, Novel Approaches to Estimate Natural Gas Emissions from Underground Pipelines using Surface and Atmospheric Concentration Measurements, Pipeline Research Council International (PRCI) 2021 Virtual Research Exchange, March 4, 2021. (Invited Presentation).

(c) Cost share activity

None this quarter. Cost share activity will be reported next quarter.

1. Background and Objectives in the 2nd Quarter

1.1 Background This project will (1) develop, test, and deploy an innovative decision-making protocol for methane detection and quantification of belowground leaks using near real-time data and (2) establish a recommended practice to deploy the gas sensing protocol that provides and ensures that these protocols are widely applicable and accessible to end users. To accomplish the research goals, we've teamed with partners to include pipeline operators and service providers to help develop a clear understanding of current gas leak repair and monitoring protocols, provide expertise/ lessons learned, provide access to leakage sites and serve on a technical advisory panel.

1.2 Objectives in the 2nd Quarter – The main objective of Q2 was to develop/convene the project guidance committee (Task 1), work on methods/protocol development (Task 2.0, subtask 2.1 and 2.2), and preliminary testing at METEC (Task 3) as seen in the project timeline table below. Details of each task follow.

(d) Task 1: Develop / Convene Project Guidance Committee

Background/objectives: The purpose of this task is to develop a confirmed set of participants to serve in the project guidance committee based upon governance structures developed in prior studies.

Results and Discussion: We had an industry partner meeting in January 2021 to review sensor network progress. We finalized the project guidance committee to include 4 industry operators.

Future work: Upcoming meeting with project guidance committee in April 2021.

(e) Task 2.0: Methods/Protocol Development

Background/objectives: The objective of methods/protocol develop is the development of the sensor network and the simulation-optimization algorithm. Q2 focuses on subtask 2.1 and 2.2 which are the methane detector network development and algorithm. This includes the further development of the methane detector as well as the development of a detector network capable of collecting and integrating data from multiple detectors real-time.

Results and Discussions.

Controlling software was modified to improve data collection process. The collected data can be monitored on website for end users. The website is now live and running continuously.

Future work:

Future work will continue with the software, hardware and testing of the detectors and the detector network. This includes updating the website software so that data can be shared more easily, finalizing and producing the detector components as well as build and update the software nodes. The website visualization will be improved. Simulation-optimization algorithm will be evaluated after current detector network is optimized with the website.

(f) Task 3.0: *METEC testing of sensor deployment & Simulation-Optimization Algorithm*

Background/objectives: The objective of METEC testing is to evaluate the performance of the sensor network and the simulation-optimization algorithm. Q2 focuses testing at a miniature test bed. This includes the further evaluation of the methane detector as well as the improvement of a detector network capable of collecting and integrating data from multiple detectors real-time.

Results and Discussions.

A new enclosure for detector was tested at a miniature test bed, and we are finalizing the design.

Future work:

Prior to production, additional testing on the miniature test bed will be continued to work out potential design issues. This testing will continue with the prototype, then with the production models. Once the production model is finalized, then the transition to outdoor experimental tests can occur. The results from preliminary outdoor experiments will be used to improve the algorithm.