Quarterly Report

Date of Report: July 1st, 2020
Contract Number: PHMSA-RA-DTPH56-17-RA-00002
Prepared for: Pipeline and Hazardous Materials Safety Administration (PHMSA)
Project Title: Tools for Predicting Gas Migration and Mitigating its Occurrence/Consequence
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For quarterly period ending: June 30th, 2020

Results and Conclusions:

In this quarter, we have continued to make progress. We finished and submitted a peer reviewed paper on a novel surface concentration approach for estimating leak rates for underground natural gas pipelines which is applicable to gas gathering and distribution systems, opening up the possibility of estimating the leak size of every discovered leak. We also continued to investigate the parameters affecting gas migration in soil and performed statistical analysis using the leak response survey. Due to the novel coronavirus, we postponed the industry site experimental work scheduled to take place in May 2020 to the next quarter for safety reasons. Current plans are to perform the field investigation in August.

We have worked on the following tasks to achieve the proposed work in this project (The task number follows the numbering in the project timeline):

Task 4: Validation of analytic tool

We submitted a manuscript to publish the analytic tool developed in this project. The manuscript is currently under review. We believe that the findings/results are important, and the analytic tool measures emission rates from underground pipeline leaks.

We performed a series of experiments at METEC to include three weeks of gas migration studies in which leakage rates were widely varied from low to high conditions while simultaneously measuring various environmental parameters. What was unique about these experiments is the long experimental times allowing us to capture diurnal variations. This data set is the first of its kind and will be useful in the validation of the analytic tool as well as further understanding the degree to which controlling parameters affect subsurface NG migration. Data analysis is currently in progress.

Tasks 3&4: Develop & deploy leak detection survey tool

We analyzed survey data and performed statistical analysis to understand the parameters affecting gas migration in soil. We drafted a manuscript on the topic and will meet next month with industry and regulatory partners to discuss the findings and their implications.

Task 5: Incorporate knowledge into state practices

We are in the process of summarizing the reviewed literature for initial detect/repair teams and first responders. Specifically, we reviewed current training/information on gas migration through the subsurface and wrote a draft report on the topic.

Publications/presentations:

April 8th – Virtual meeting with project industry partners to present results of analytic tool and coordinate follow on field experiments
April 17th – Virtual meeting with regulatory partners to present results of analytic tool
May 12th – Invited speaker at the Methane Emission Technology Evaluation Center (METEC) industry meeting, presenting experimental findings on gas migration to over 50 industry advisory members.

Cho, Y., B. Ulrich, D. Zimmerle, K.M.Smits, Novel Dimensionless Surface Concentration Number Approach for Estimation of Leak Rates from Underground Natural Gas Pipelines, Sci. Total Env., *in review.*

Plans for Future Activity:
Future experiments will focus on developing a quantitative method to predict leakage rates based on above-ground gas concentrations and atmospheric conditions. These experiments will evaluate (1) the extent of subsurface gas migration over a range of realistic natural gas leakage rates, and (2) the effect of wind conditions on above-ground gas concentrations that arise from underground leaks. Results from these studies will be used to calibrate numerical models to predict gas above-ground and below-ground migration behavior for a wider range of potential field conditions. Future modeling work will be extended to different obstruction conditions, vegetation, soil layering, and other environmental parameters. Future experiments will focus on developing a quantitative method to predict leakage rates based on surface and above-ground gas concentrations.