CAAP Quarterly Report

Date of Report: *June 30, 2016*

Contract Number: *DTPH5615HCAP02*

Prepared for: *US DOT - PHMSA*

Project Title: *"Understanding and Mitigating the Threat of AC Induced Corrosion on Buried Pipelines"*

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For quarterly period ending: *June 30, 2016*

Business and Activity Section

(a) Generated Commitments –
Materials and supplies – chemicals, machine shop work to fabricate samples

(b) Status Update of Past Quarter Activities –

Summary:
On May 20 2016 the University of Akron PI Scott Lillard and student Elmira Ghanbari hosted a meeting with the DOT-PHMSA Project Manager Joseph Mataich. During this meeting Ghanbari gave a presentation of her work on AC corrosion and the the program path forward was discussed

Experimental details:

- AC corrosion experiments in NS4 soil simulant:
  - Performed long-term potentiostatic experiments at the CP potential with impressed AC potential on API X65 carbon steel.
  - Conducted EIS experiments. Fitted values of interfacial capacitance for each experimental data point in the previously proposed theoretical model.
  - Compared experimental data of AC corrosion of X65 along with data obtained from the theoretical model in NS4 solution with those in NaCl solution.
  - Experimental and theoretical analysis and comparison of different scales grown on API X65 in NS4 soil simulant with applied AC and DC potentials.
  - Rates for calcium carbonate coated steel at CP where more than an order of magnitude lower than untreated steel. The result goes to show the importance of soil properties.
  - It was also found that there was no correlation between total AC current and corrosion rate of the sample. This finding demonstrates the importance of other soil parameters such as interfacial capacitance and soil resistivity.

- Deposition of iron carbonate on X65 carbon steel:
  - Iron (II) carbonate growth on API X65 carbon steel in carbon dioxide-saturated NaCl brine solution at the open circuit potential.
  - Used SEM to measure fractional surface coverage of carbonate layer on X65 with time.
  - Performed in situ EIS analysis as calcareous deposits were forming on X65 at different time intervals to characterize the growth of iron carbonate layers. Data where benchmarked with SEM csurface coverage measurements.

- Performed SEM / FIB characterization of carbonate layers after deposition.
- Performing a long term (30 days) potentiostatic experiments at cathodic protection potential (-0.85 $V_{Cu/CuSO4}$) with 3 V impressed AC potential on API X65 carbon steel with and without $FeCO_3$ layer in NS4 solution.

Description of any Problems/Challenges –

- None to report

(c) Planned Activities for the Next Quarter –

- Input of carbonate data into our model of AC corrosion to analyze the influence of layer capacitance on corrosion rate.