Public Quarterly Report

Date of Report: *2nd Quarterly Report, March 29, 2023*
Contract Number: *693JK32210001POTA*
Prepared for: *Government Agency: DOT and Co-funders*
Project Title: *Developing Corrosion Control Monitoring Technology for Hazardous Liquid Breakout Tanks*
Prepared by: *Pipeline Research Council International, Inc.*
Contact Information: *Laurie Perry, email: lperry@prci.org phone: 571-600-2002*
For quarterly period ending: *March 31, 2023*

1: Items Completed During this Quarterly Period:

Item #	***Task #***	***Activity/Deliverable***	***Title***	***Federal Cost***	***Cost Share***
1	*1*	*Research, literature review, summarize, and document current monitoring practices*	*Summary of the literature review and survey results on monitoring included in the quarterly report*	*$10,351*	*$10,351*
3	*2*	*Planning and coordination of the field testing and procurement of the materials and supplies*	*Summary to be included in the quarterly report*	*$11,401*	*$11,401*
4	*4*	*Planning and coordination for laboratory experiments and the large-scale control experiments, and procurement of materials and supplies*	*Summary to be included in the quarterly report*	*$12,559*	*$12,559*
6	*1*	*Analyze API 653 inspection report data for the tanks on concrete pads, provide data summary*	*Summary of the API 653 inspection report data for the tanks with concrete pads included in the quarterly report*	*$24,773*	*$24,773*
8	*2*	*Start of the field testing, laboratory experiments, and large-scale control experiments*	*Details of the field testing started during the second quarter will be included in the quarterly report*	*$8,144*	*$8,144*
9	*4*	*Start of the laboratory experiments and large-scale control experiments*	*Details of the laboratory and large-scale control experiments during the second quarter will be included in the quarterly report*	*$8,144*	*$8,144*

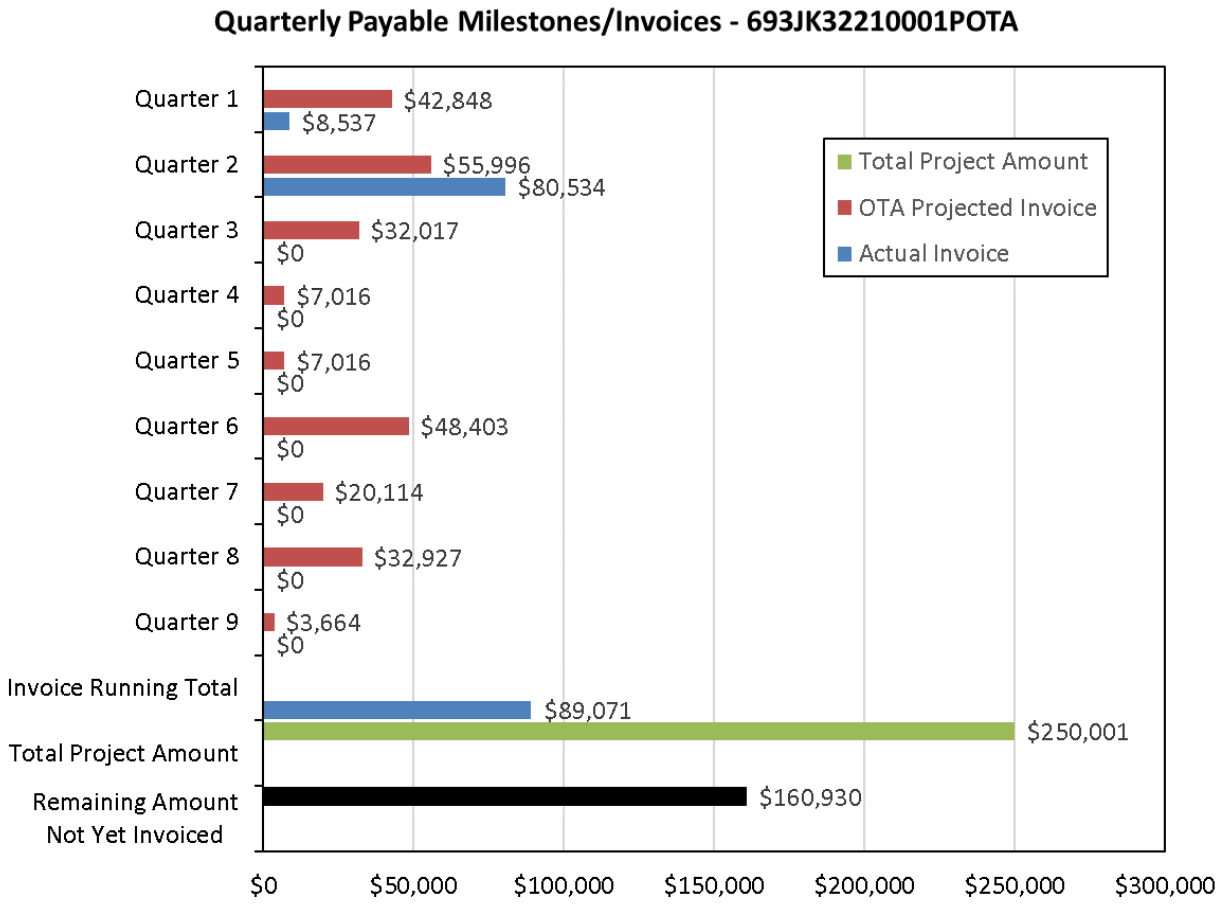
10	*5*	*Quarterly Project Management & Status Update Reporting*	*Submit 2nd quarterly report*	*$5,162*	*$5,162*

2: Items Not Completed During this Quarterly Period:

Item #	***Task #***	***Activity/Deliverable***	***Title***	***Federal Cost***	***Cost Share***
7	*3*	*Evaluating Effect of CP on Tank Bottom Corrosion*	*Summary of the API 653 inspection report data for approximately 150 tanks with CP systems included in the quarterly report*	*$9,772*	*$9,772*

3: Project Financial Tracking During this Quarterly Period:

Note that this chart reflects Federal share only.



4: Project Technical Status:

The following activities were undertaken:

Item 1, Task 1 — Research, literature review, summarize, and document current monitoring practices, Summary of the literature review and survey results on monitoring included in the quarterly report: The search resulted in identification of two relevant literatures where coupons and sand sampling were used to determine corrosivity of the tank sand pads. In addition, the PRCI Phase 2 study work is consistent with the scope of the item. Overall findings of the literature search are following:

- *Zee et al. (Reference a) reported two case studies where CP protected ASTs failed, and through wall holes. The authors investigated the role of monitoring the corrosive environment of the tank bottom in determining predictive maintenance plans to increase the service life of the tank. The authors proposed use of the electrical resistance (ER) probes for the corrosion monitoring. The authors also promoted the idea of sand interstitial sampling and monitoring those samples for corrosive species such as chloride and sulphate.*
- *Ghafri et al. (Reference b) performed various cased studies in CP-protected tanks that had failed within 8 years of commissioning. The authors recommended using the ER probes for monitoring the tank pad corrosivity.*
- *PRCI Phase 2 (Reference c) exhaustively investigated the use of corrosion monitoring tools to soil side corrosion on the tank bottoms; the study concluded that mass-loss coupons placed few inches below the bottom provide a reasonable assessment of the bottom's corrosion at a given location, and targeted monitoring distributed through the bottom floor can be used to obtain a reasonable assessment of the tank pad corrosivity.*

References:

a) *M. Zee, A. K. Chikkam, E. Larkin, P. Taheri, A. Rezaie, A. Campbell, "Corrosion Risk Assessment, Failure Analysis and Corrosion Mitigation for Aboveground Storage Tanks and Case Histories." In Proceedings of CORROSION 2019, Paper No. 12826 (Houston, TX, NACE, 2019).*
b) *A. A. Ghafri, J. R. Nair, N. A. Abri, L. A. Shibli, "Successful Implementation of a Corrosion Management Strategy by Online Injection of Vapor Phase Corrosion Inhibitors to Extend Storage Tank Floor Life," In Proceedings of CORROSION 2018, Paper No. 11428 (Houston, TX, NACE, 2018).*
c) *P. Shukla, A. Nordquist, R. Fuentes, B. Wiersma, "Vapor Corrosion Inhibitors Effectiveness for Tank Bottom Plate Corrosion Control − Ph2," Report Catalog Number PR644-183611-R01, PRCI, Chantilly, Virginia, 2022.*

A survey was conducted to identify various monitoring methods used by tank operators in field. The survey was sent to nine tank operators, seven tank operators provided responses. The survey responses are provided in Appendix B. This item has been completed and satisfies item 1 in Attachment 2 Project Deliverables. This item also links to item 3 in Attachment 1 Team Project Activities.

Item 3, Task 2 — Planning and coordination of the field testing and procurement of the materials and supplies, Summary to be included in the quarterly report: Field testing has been started with nine tanks. Sand samples from those tanks has been analyzed, and mass-loss coupons have been placed under the tanks. This item has been completed and satisfies item 2 in Attachment 2 Project Deliverables. This item also links to item 4 in Attachment 1 Team Project Activities.

Item 4, Task 4— Planning and coordination for laboratory experiments and the large-scale control experiments, and procurement of materials and supplies, Summary to be included in the quarterly report: Two laboratory-scale experiments have been started, the experiments' data will be used to determine the VCI reinjection interval. And supplies for additional two experiments are being procured. The supplies include two specialized glass vessels and four ER probes. A detailed design and planning for the control large-scale experiment has been completed and procurement of various materials and supplies is in process. Approximately 300 mass-loss coupons, and 32 ER probes are being procured. This item has been completed and satisfies item 3 in Attachment 2 Project Deliverables. This item also links to item 4 in Attachment 1 Team Project Activities.

Item 6, Task 11— Analyze API 653 inspection report data for the tanks on concrete pads, provide data summary, Summary of the API 653 inspection report data for the tanks with concrete pads included in the quarterly report: The tank operators provided data for twelve tanks with concrete tank pad and having an API 653 floor inspection. Following observations were made based on analysis of the floor inspection data for nine tanks: maximum corrosion rates for the five tanks ranged between 5 to 11 mpy, and for remaining four tanks were below 5 mpy. The corrosion on the tanks bottom with corrosion rates ranging between 5 to 11 mpy was not widespread. This item has been completed, and satisfied item 4 in Attachment 2 Project Deliverables. This item also links to item 5 in Attachment 1 Team Project Activities.

Item 8, Task 2 — Start of the field testing, laboratory experiments, and large-scale control experiments, Details of the field testing started during the second quarter will be included in the quarterly report: The field testing has been started with nine tanks. Field sand samples were received and analyzed. Mass-loss coupons assemblies have been placed under the tanks at targeted locations. The coupons will be extracted after nine months. The data from the current testing and from previous PRCI studies will be analyzed to understand the role of monitoring for corrosion control of ASTs. This item has been completed, and satisfied item 2 in Attachment 2 Project Deliverables. This item also links to item 9 in Attachment 1 Team Project Activities.

Item 9, Task 4 — Start of the field testing, laboratory experiments, and large-scale control experiments, Details of the laboratory and large-scale control experiments during the second quarter will be included in the quarterly report: Two laboratory scale experiments have been started; these experiments are being conducted to determine the VCI reinjection interval. In each of the two experiments, a 3-ft long and 5.5-inch ID tube is filled with field sand, one end of the tube will be used to inject VCIs, and the VCIs will be allowed to escape from the other end. ER probes are being used to monitor the change in corrosion rates; the corrosion rate change data will be used to develop a criterion for VCI injection. Planning for the large-scale has been completed, and various materials and supplies are being procured. This item has been completed, and satisfied item 6 in Attachment 2 Project Deliverables.

Item 7, Task 3 — Evaluating Effect of CP on Tank Bottom Corrosion, Summary of the API 653 inspection report data for approximately 150 tanks with CP systems included in the quarterly report: The data for tanks have been collected but has not been analyzed yet. The activity has not been completed yet.

Item 10, Task 5 — Quarterly Project Management & Status Update Reporting, Submit 2nd quarterly report: A 2nd quarter project meeting was held; the meeting minutes are provided in the Appendix. This item has been completed. The above links to item 12 as listed in Attachment 1 Project Team Activities. This item also links to item 9 in Attachment 1 Team Project Activities. This item also links to item 10 in Attachment 1 Team Project Activities.

5: Project Schedule:

The following items were not completed in the second quarter due to contracting delay between PRCI/BSRA.

Item 7, Task 3 —Evaluating Effect of CP on Tank Bottom Corrosion, Summary of the API 653 inspection report data for approximately 150 tanks with CP systems included in the quarterly report: The data for tanks have been collected but have not been fully analyzed yet.

The above item will be completed in the next quarter. The project team plans to accelerate work in the next quarter, to get the project schedule on track.

The project has caught considerably but is still behind schedule.