Working Group #6
Breakout Tanks –
Methods to Prevent Corrosion of Tank Bottoms

Working Group Leaders:

Zaid Obeidi: General Engineer, PHMSA
Chris Aldrich: Integrity Management Program Coordinator, Marathon Pipe Line LLC
Justin Samuel: Engineer, Integrity Tech Services, Phillips 66
John G Field: Corrosion Engineer, Energy Transfer Partners

Pipeline Transportation: Hydrogen and Emerging Fuels R&D Public Meeting and Forum
November 30 – December 2, 2021

Top 4 Identified R&D Gaps

Gap #1 – Corrosion Control Tank - Monitoring (Output type: Technology Development)(Infrastructure type: Breakout Tanks)

Gap #2 – Standardize Vapor Corrosion Inhibitors (VCI) (Output type: Technology Development) (Infrastructure type: Breakout Tanks)

Gap #3 – VCI Compatibility (Output type: Technology Development) (Infrastructure type: Breakout Tanks)

Gap #4 – Tank Foundation/Pad (Output type: General Knowledge) (Infrastructure type: Breakout Tanks)

Gap #1 Associated Details

Title: Corrosion Control Tank - Monitoring

Main Objective: Conducive to multiple technologies to monitor the tank bottom corrosion conditions.

a. What operating environment(s) must the technology operate in (inside/outside-pipe, above/under-ground, hazardous liquid or natural gas service, etc.)?
   - Under primary tank bottom (monitoring will be placed within the electrolyte (sand, concrete, etc.) to monitor the tank bottom)
   - Between the bottoms or within the electrolyte
   - Under original floor

b. Can any functionality and or performance requirements be identified (must produce what data, must have a certain threshold of detection, etc.)?
   - Either direct corrosion growth rate mils per year (MPY) obtained from monitoring or indirect (e.g., CP, VCI concentration levels)
   - Able to incorporate CP (how CP influences corrosion rate)

c. Does the gap address any regulatory, congressional, or NTSB drivers (more than one category can be included)?
   - Yes, based on current consolidated appropriation act of 2021 (PHMSA's future congressional report)

d. Does the gap address any related consensus standards or best practices?
   - Yes, neither API TR 655, API RP 2610 nor the upcoming AMPP (SP21474) external corrosion control of carbon steel AST bottoms addresses monitoring in any detail
   - API RP 651
   - NACE SP0193

e. What technical or regulatory roadblocks or barriers prevent the technology deployment?
   - Technical roadblocks – VCI chemistries are proprietary, how do we confirm we've got an adequate concentration under the tank when we don't know how long it takes for the VCI application to disperse through the sand pad or if it is dispersed effectively? Or are we just creating caverns through the sand pad under the tank?
   - Regulatory roadblocks: We need regulators to approve alternatives to failed/failing CP systems based on industry verification/validation of researched data
   - Industry request for special permit and state waiver for VCI applications

f. What are anticipated targets or timeframes to complete this research (months)?
   - Short-term (2 years)

g. What funding level is estimated to support such a topic?
   - $300,000 - $500,000

Gap #2 Associated Details

Title: Standardize Vapor Corrosion Inhibitors (VCIs)
Main Objective: Develop standardized methods to qualify VCIs for tank bottom application and receive Industry/PHMSA approval

a. What operating environment(s) must the technology operate in (inside/outside-pipe, above/under-ground, hazardous liquid or natural gas service, etc.)?
   - Under primary tank bottom
   - Between the bottoms or within the electrolyte
   - Under original floor

b. Can any functionality and or performance requirements be identified (must produce what data, must have a certain threshold of detection, etc.)?
   - Either direct corrosion growth rate mils per year (MPY) or per API 653 obtained from monitoring or indirect (e.g., CP, VCI concentration levels)

c. Does the gap address any regulatory, congressional, or NTSB drivers (more than one category can be included)?
   - Yes, based on current consolidated appropriation act of 2021 (PHMSA's future congressional report)

d. Does the gap address any related consensus standards or best practices?
   - Yes, neither API TR 655, API 2610 nor the upcoming AMPP (SP21474) external corrosion control of carbon steel AST bottoms addresses monitoring in any detail

e. What technical or regulatory roadblocks or barriers prevent the technology deployment?
   - Regulatory roadblocks: We need regulators to approve alternatives to failed/failing CP systems based on industry verification/validation of researched data
   - Industry request for special permit and state waiver for VCI applications

f. What are anticipated targets or timeframes to complete this research (months)?
   - Short-term (standards needed)

g. What funding level is estimated to support such a topic?
   - $200,000 - $250,000

Gap #3 Associated Details

Title: Vapor Corrosion Inhibitors Compatibility
Main Objective: Evaluate long-term interactions between VCI and CP and associated components

a. What operating environment(s) must the technology operate in (inside/outside-pipe, above/under-ground, hazardous liquid or natural gas service, etc.)?
   - Under primary tank bottom
   - Between the bottoms or within the electrolyte
   - Under original floor

b. Can any functionality and or performance requirements be identified (must produce what data, must have a certain threshold of detection, etc.)?
   - Either direct corrosion growth rate mils per year (MPY) or per API 653 obtained from monitoring or indirect (e.g., CP, VCI concentration levels)
   - Polarization criteria
   - VCI chemical stability with operating CP
   - Anode performance
   - Electrolyte compatibility with VCI

c. Does the gap address any regulatory, congressional, or NTSB drivers (more than one category can be included)?
   - Yes, based on current consolidated appropriation act of 2021 (PHMSA's future congressional report)

d. Does the gap address any related consensus standards or best practices?
   - Yes, neither API TR 655, API 2610 nor the upcoming AMPP (SP21474) external corrosion control of carbon steel AST bottoms addresses VCI/CP interaction in any detail
   - API RP 651
   - NACE SP0193

e. What technical or regulatory roadblocks or barriers prevent the technology deployment?
   - Regulatory roadblocks: We need regulators to approve alternatives to failed/failing CP systems based on industry verification/validation of researched data
   - Industry request for special permit and state waiver for VCI applications

f. What are anticipated targets or timeframes to complete this research (months)?
   - Short-term (1-2 years)

g. What funding level is estimated to support such a topic?
   - $300,000 - $500,000

Gap #4 Associated Details

Title: Tank Foundation/Pad
Main Objective: Evaluating various foundation/pad designs for corrosion control

a. Does the gap address any regulatory, congressional, or NTSB drivers (more than one category can be included)?
   - Yes, based on current consolidated appropriation act of 2021 (PHMSA's future congressional report)

b. Does the gap address related consensus standards or best practices?
   - Yes, neither API TR 655, API RP 2610 nor the upcoming AMPP (SP21474) external corrosion control of carbon steel AST bottoms addresses monitoring in any detail
   - API RP 651
   - NACE SP0193
   - API RP 653

c. What technical details or scope items are necessary and recommended?
   - Specific designs for tanks sitting on various pads types (e.g., concrete, asphalt, etc.)
   - Application/design of leak detection barriers (HDPE, claymax, etc.) (Release prevention barrier versus berm/dike liner)
   - Tank sealing (chime or dead shell seal)
   - Cone up/Cone down drainage
   - Leak detection methods

d. What are anticipated targets or timeframes to complete this research (months)?
   - Short-term (information is available)

e. What funding level is estimated to support such a topic?
   - Data analysis and knowledge sharing
   - $100,000 - $200,000

Additional Identified Gaps

1. **Corrosion Control Tank Design**

Thank You!/Questions?