Vapor Corrosion Inhibitors for AST Corrosion Protection

Presented by Kelly Baker, Zerust Oil & Gas Northern Technologies International Corporation, USA
AGENDA

• Introduction
• What are VCIs
• Industry Applications
• Tank Floors – Several Options
• Cone Roofs
• Floating Roofs
• Pipe Casings
• Questions
How Do VCIs Work?

Barriers

• Acts as a barrier layer between the metal and the environment.
• **Adsorption** can be either physical (electrostatic) or chemical (sharing electrons)
Vapor Pressure

- The **pressure** exerted by the gas in equilibrium with a solid or liquid in a closed container at a given temperature is called the **vapor pressure**.
Definition – Con't

Different Chemical Mechanisms for Different Purposes

• Barriers
  ➢ Act as a barrier layer between the metal and the environment, adsorption can be either physical (electrostatic) or chemical (sharing electrons)

• Passivators

• Scavengers

• Neutralizer
Enclosure

- An enclosed space
An Expensive Steel Asset!
How do you protect it?

Ribbon Anodes!
How do you protect it?

Impressed Current!
WHAT IF?

• No Cathodic Protection (CP)
• Tank is In-Service
• CP System is Aging
• Double Bottom – Limited Clearance
• Liner Under the Sand Pad w/ground-bed CP
• Concrete or Asphalt Pad
• Pipe Casing - Metallically Shorted
Corrosion cannot be eliminated, it’s mechanism can only be slowed down

Failure “prevention” provides a better return on investment than failure “management”
Applications!

Tank Floors!
Soil Side Bottom (SSB)
Single Bottom w/ RPB
Slurry as Carrier
Single Bottom w/o RPB
Vapor Pressure as Carrier
Concrete or Asphalt Pads
Double Bottom

- New Bottom Plate
- Cathodic Protection Conduit / Leak Detection Pipe
- Old Bottom Plate
- Sand Bed
- Leak Prevention Liner (HDPE)
Other Designs
Monitoring Options

Coupons

Data Logger

ER Probe
### SSB - ER Probe Data

<table>
<thead>
<tr>
<th>Corrosion Rate</th>
<th>6 Month Rolling Average</th>
<th>% of Total</th>
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<tbody>
<tr>
<td>&lt; 1 mpy</td>
<td>139</td>
<td>81.29%</td>
</tr>
<tr>
<td>1 - 2 mpy</td>
<td>19</td>
<td>11.11%</td>
</tr>
<tr>
<td>2 - 3 mpy</td>
<td>7</td>
<td>4.09%</td>
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<tr>
<td>&gt; 3 mpy</td>
<td>6</td>
<td>3.51%</td>
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<tr>
<td></td>
<td>171</td>
<td>100.00%</td>
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</table>
Applications!

Tank Roofs!
Cone roof supports!

Continuity of coatings?

Tank roof and support beam

Coatings do not effectively cover all surfaces
Mitigate Roof Underside Corrosion

The delivery system!

*Hot work – cut hole*

*Install dispensers*
Dispenser Placement

25.1m = 72.5ft Diameter
- Expected avg. cycling of 1 time per week
- Total Recommended Dispensers = 13

55m = 180ft Diameter
- Expected avg. cycling of 1 time per week
- Total Recommended Dispensers = 51
Roof System
Mono-Molecular Barrier

VCI takes precedence on steel surface
Extend Roof Life

Field Trial Tests Results

Loss of roof thickness due to corrosion of control (A) and test (B) tanks
Applications!

Other Applications!
Wiper Blade Area & Pontoons
Roof Legs

8 Months

No Protection  Inhibited Grease  +  Leg Sock
Pipe Casings

Complies with NACE SP200-2014 and PHMSA guidelines
SP200-2014 Steel Cased Pipeline Practices

Appendix “A” – Options for Mitigation of Carrier Pipe Corrosion in the Casing Annulus

• **A3.2 Option #1:** Inject the casing with Corrosion Inhibiting Gel Filler

• **A3.3 Option #2:** Apply a Multiphase Vapor Corrosion Inhibitor System
1. VCI’s are a cost effective alternative or addition to, traditional corrosion protection methods.

2. VCI’s can be applied to most environments while the asset is in service.

3. VCI’s are effective for many years and are easily replenished.

4. VCI’s can be applied to almost any enclosed environment.
Thank you!

Questions?

Kelly Baker
kbaker@ntic.com
832-465-5668