ENERGY TRANSFER

Monitoring Techniques for Soil-Side Corrosion on AST Bottoms

John Field

Corrosion Engineer, NACE CP Specialist

Energy Transfer

Outline

- Methods of Monitoring Soil-Side Corrosion on Tank Bottoms
  - Out-of-Service Inspections
  - Perimeter Reference Cell Readings
  - Permanent Under-Tank Reference Cells
  - Reference Cells with Slotted Insertion Tubes
  - Electrical Resistance Probes
- Specification and Placement of ER Probes
- Example Corrosion Rate Data from Under-Tank ER Probes

Methods of Monitoring

- Out of Service Tank Inspections
  - Expensive to clean and prep tank for inspection (usually 10 years between inspections)
  - Significant corrosion may occur between inspections, resulting in costly repairs or leak
- Perimeter Reference Cell Readings
  - Useful, but don't indicate CP levels under the tank bottom
- Permanent Under-Tank Reference Cells
  - Provide CP levels under the tank
  - Typically installed during tank construction or floor repair/replacement
  - Can become contaminated or high resistant over time

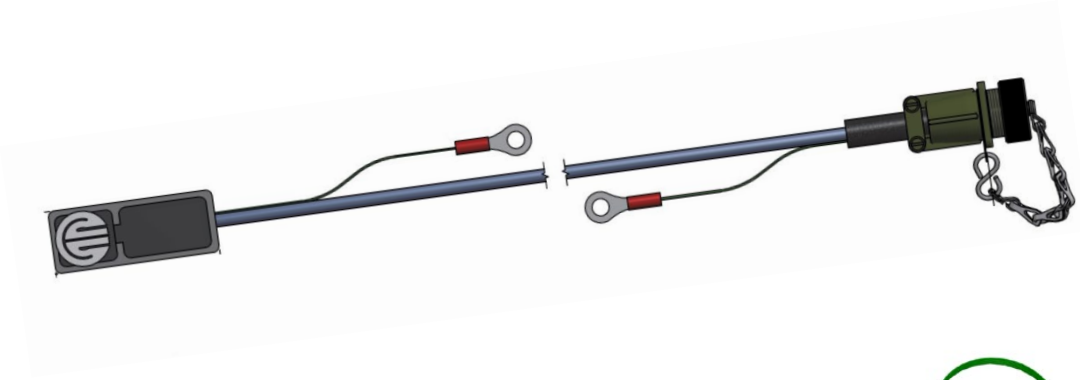
Methods of Monitoring (continued)

- Reference Cells with Slotted Insertion Tubes
  - Allows a profile of CP levels along the entire length of tube
  - Can be used to confirm PRC readings
  - May become clogged or kinked over time

- Electrical Resistance Probes
  - Measures resistance of calibrated steel element in same environment as underside of tank bottom (sand, concrete)
  - Converts resistance to metal loss in terms of mils (one thousandth of an inch) or smaller increments
  - May be used with or without CP to establish local corrosion rate
  - Element can be configured with different resolution and shape options

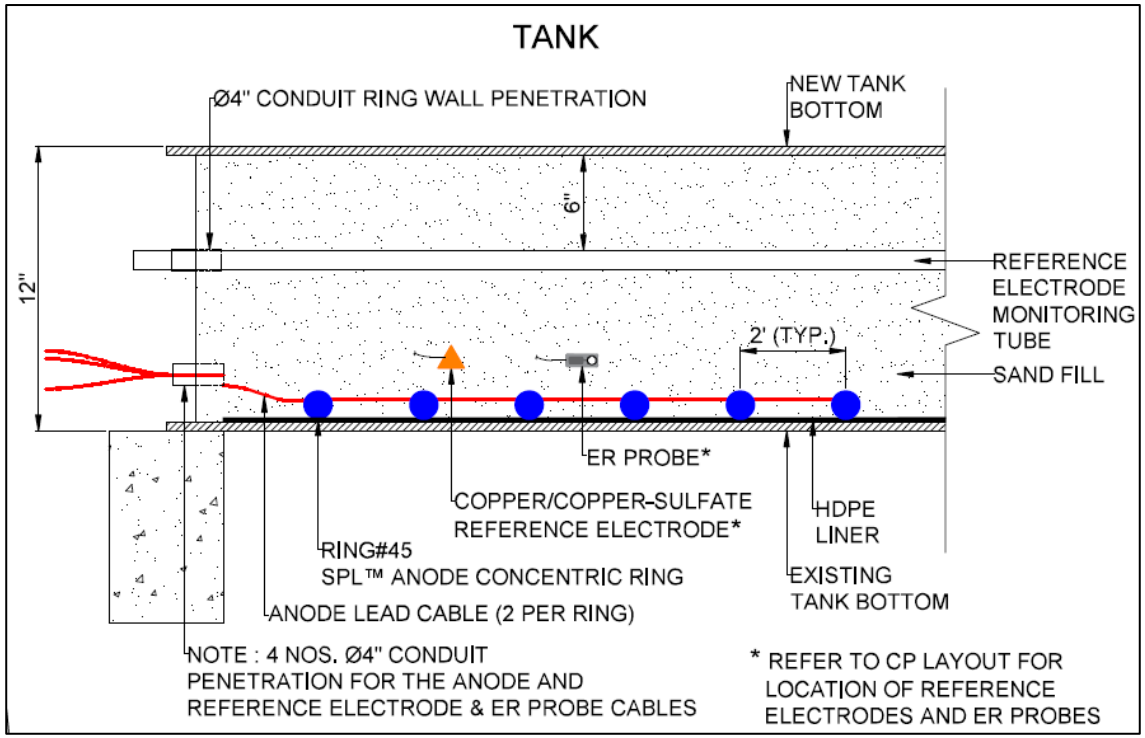
Specification & Placement of ER Probes

- Flat Elements Best Represent the Tank Bottom
- Element Thickness
  - Thicker elements have larger life span , but lower resolution
  - Thinner elements have a higher resolution, but shorter life span
- Element should be facing down in the foundation material
- Bonding Cable
  - Should be connected to tanks with CP
  - Typically left disconnected to tanks without CP



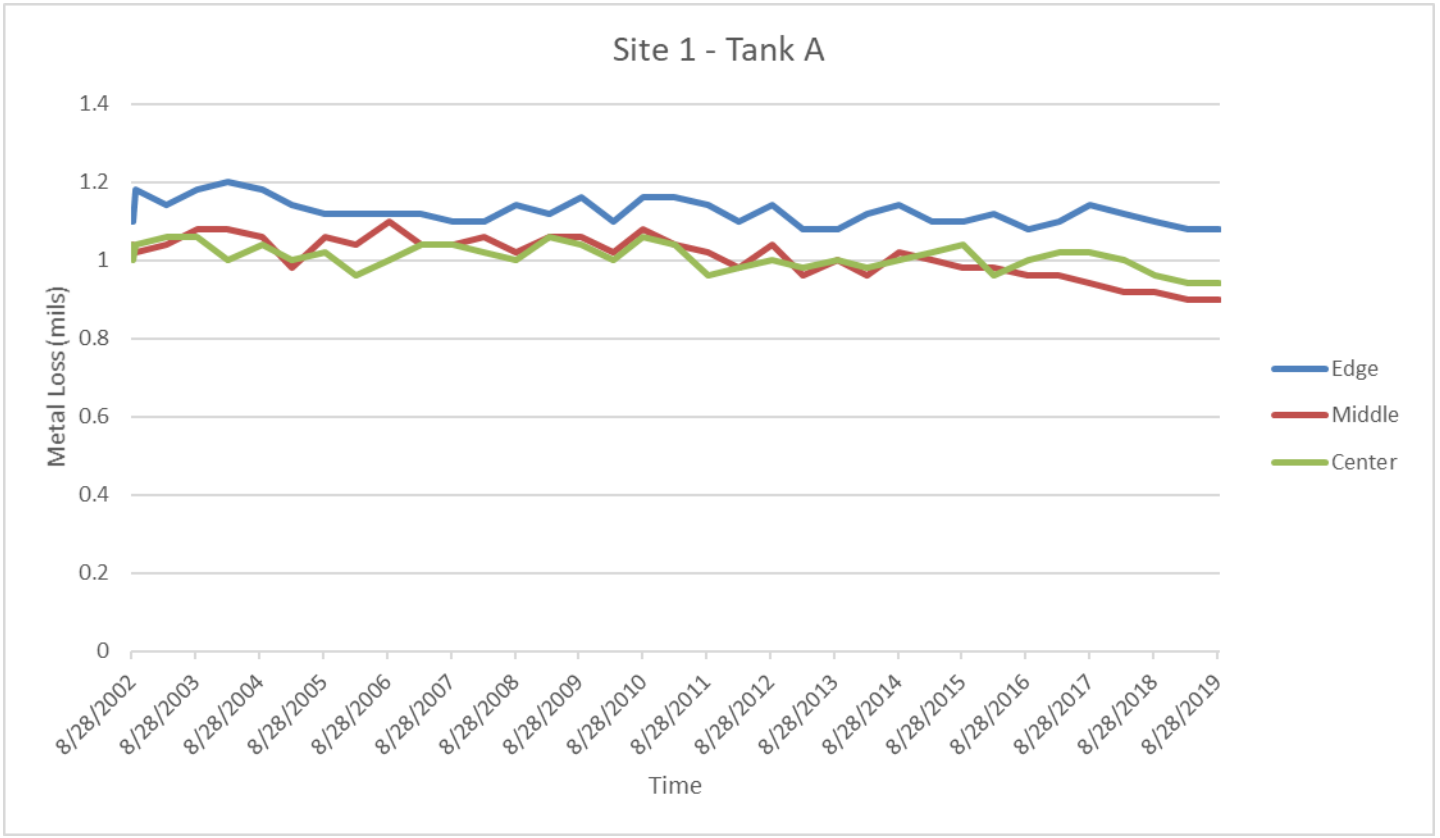
Specification & Placement of ER Probes

- Placement of ER Probes
  - One at the center of tank
  - One close to the edge (5’ to 10’ in from perimeter)
  - Space remaining probes evenly between edge and center of tank
- Place At Least Some Probes Adjacent to Reference Cells



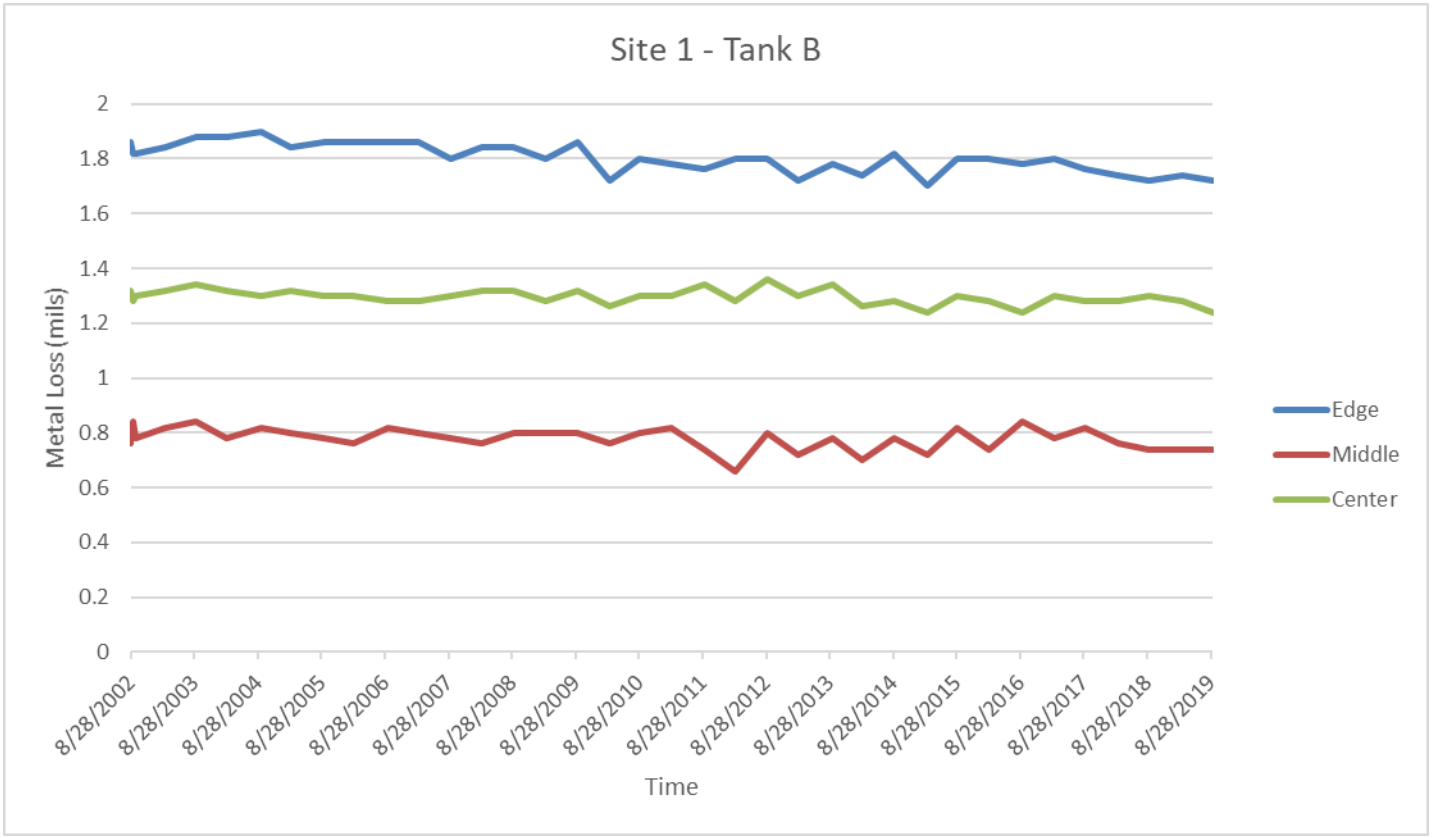
Example Corrosion Rate Data

- Double Bottom (Concrete Spacer Between New & Old Floors – El Segundo)
- Slope of Lines ~0, Equates to Corrosion Growth Rate (CGR) of 0 mils/yr



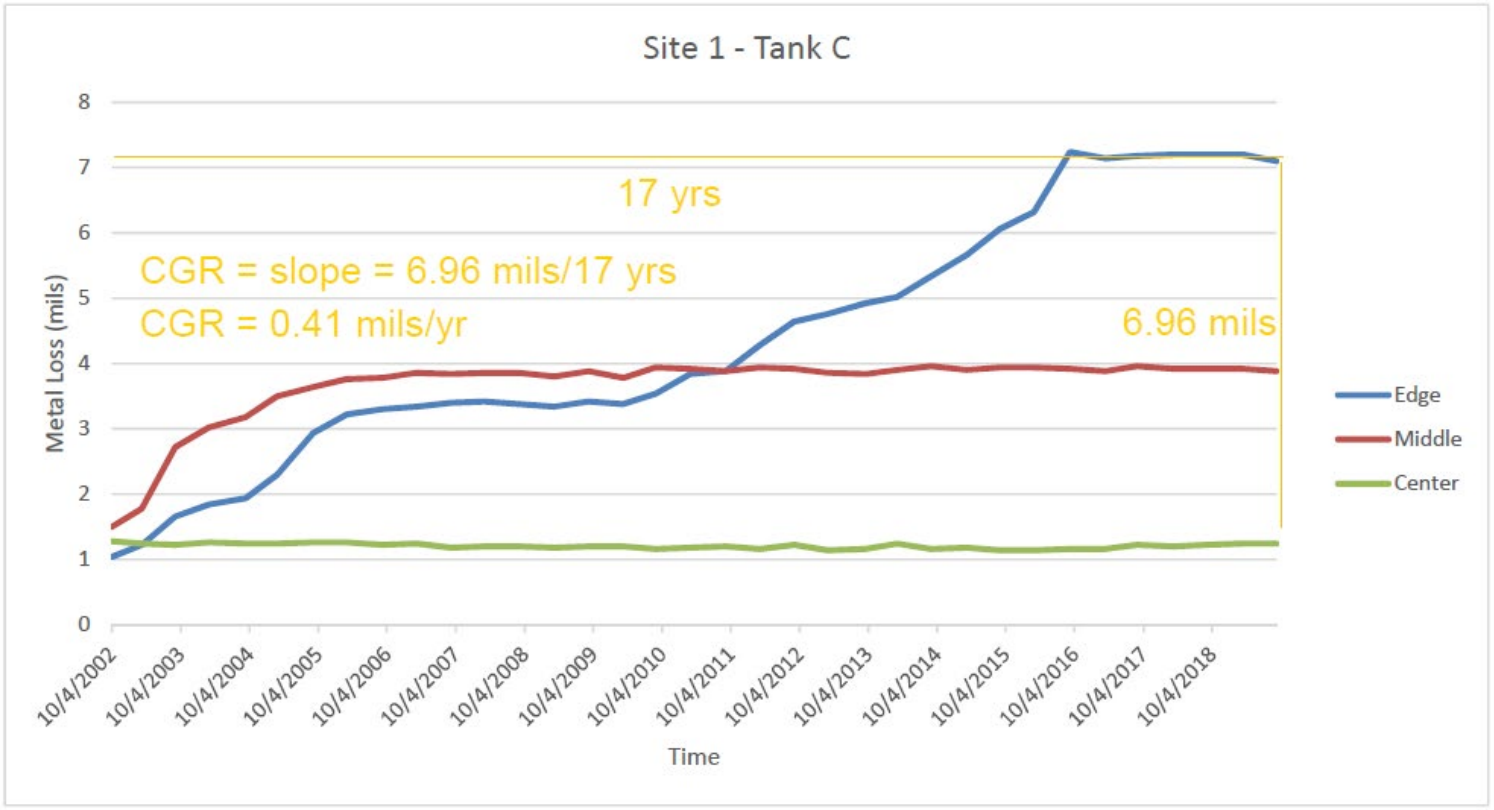
Example Corrosion Rate Data (continued)

- Double Bottom (Concrete Spacer Between New & Old Floors – El Segundo)
- Slope of Lines ~0, Equates to Corrosion Growth Rate (CGR) of 0 mils/yr



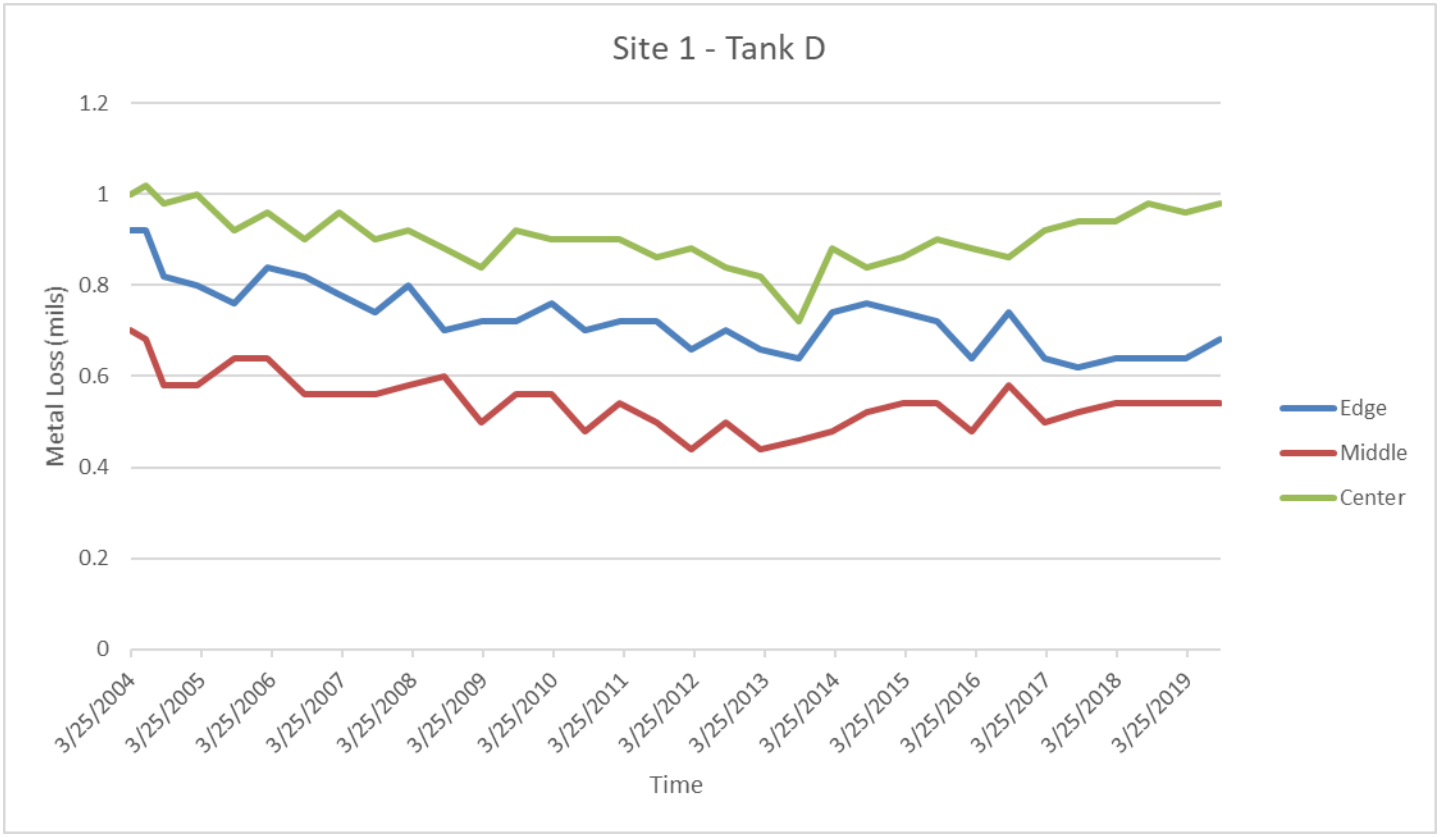
Example Corrosion Rate Data (continued)

- Double Bottom (Concrete Spacer Between New & Old Floors – El Segundo)
- Slope of Line for Edge Probe = 0.41, Equates to CGR of 0.41 mils/yr



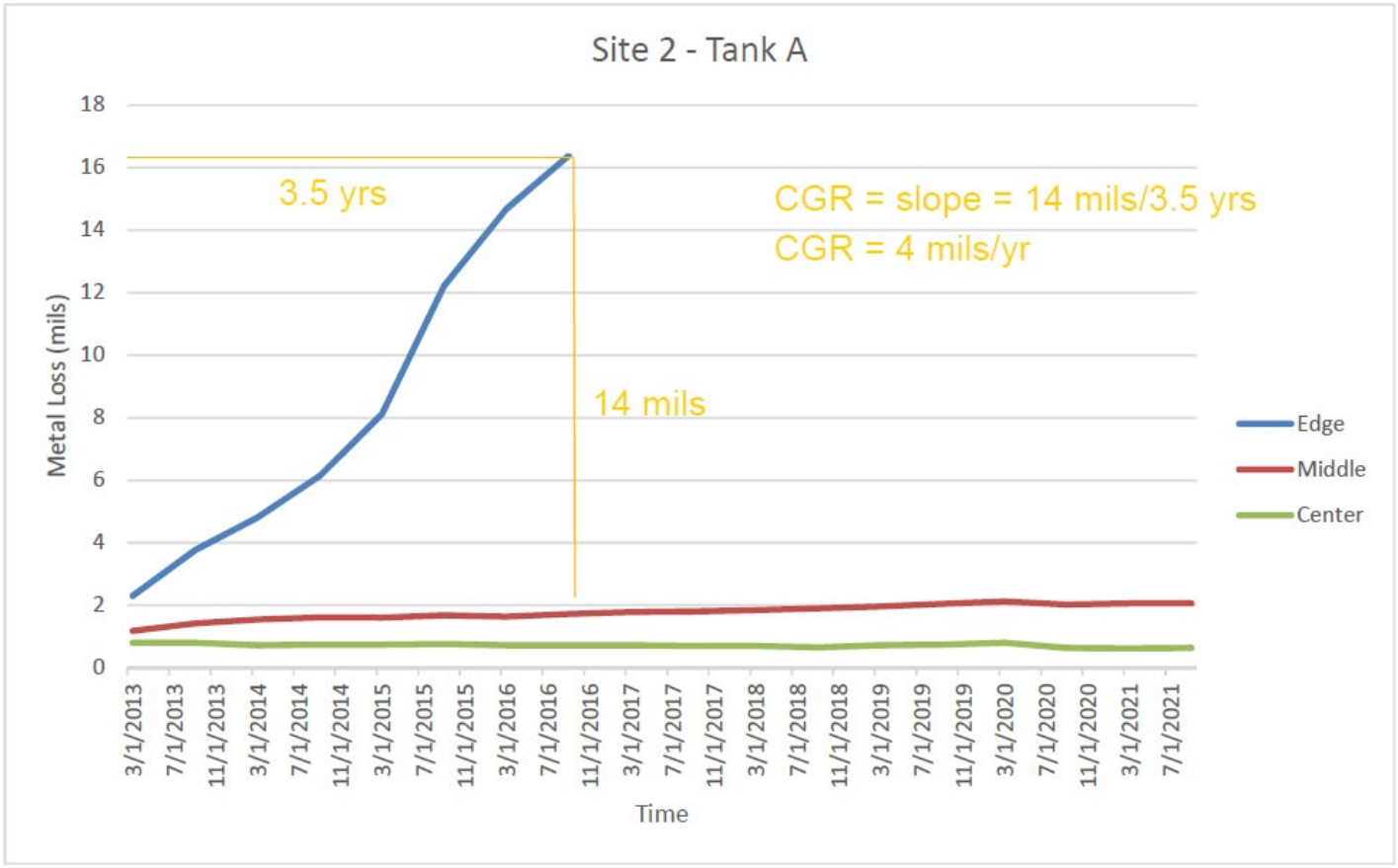
Example Corrosion Rate Data (continued)

- Double Bottom (Concrete Spacer Between New & Old Floors – El Segundo)
- Slope of Lines ~0, Equates to Corrosion Growth Rate (CGR) of 0 mils/yr



Example Corrosion Rate Data (continued)

- Double Bottom (Concrete Spacer Between New & Old Floors – El Segundo)
- Slope of Line for Edge Probe = 4, Equates to CGR of 4 mils/yr
- ER Probe Had Useful Life of ~20 mils → Only Lasted 4 Years



Example Corrosion Rate Data (continued)

- Single Bottom (Sand Foundation w/"Grid System" ICCP)
- Slope of Lines ~0, Equates to Corrosion Growth Rate (CGR) of 0 mils/yr