WHAT MAKES A CORROSION CELL?

• Anode
• Cathode
• Electrolyte – path of conductivity
  • Soil type – minerals / ph
  • Moisture
  • resistivity
• Return Curcuit
HOW DOES IT WORK?

• Corrosion Cell:
EXAMPLE OF GALVANIC SERIES

- Dissimilar Metals / Practical Galvanic Series
- Progressively more anodic to cathodic metals

Volts
- Commercially pure magnesium -1.75
- Magnesium alloy -1.5
- Aluminum alloy -1.05
- Cast Iron -0.5
- Mild Steel in concrete -0.2
- High Silicon cast iron -0.2
- Carbon, graphite, coke +0.3

Volts / potential measured when immersed in a neutral soil or water and a copper-copper sulfate reference cell contacting the adjacent soil or water.
DESIGN DECISION MODEL™

- pH
- Soil Resistivity
- Oxidation Reduction (redox) potential
- Sulfides
- Moisture
- Chlorides
- Bi-metallic considerations
- Known corrosive environments
- Consequent factors:
  - Diameter of pipe / location / depth of cover
STRAY CURRENT VS WATER JET

• Stray Current

• Water Jet
EXAMPLES

• 100+ year old pipe – Phillipsburg, NJ
  • Oxidation

• 34 year old pipe
  • Unprotected pipe
  • Galvanic corrosion
DUCTILE IRON PIPE PROTECTED WITH POLYETHYLENE

- 21 year old pipe
  - Detroit, MI

- 30 year old pipe
  - Philadelphia, PA
WHAT’S IN YOUR WATER?

• Drinking Water
  – Ph levels? Acidic / Neutral / Alkaline

• Cement Lining
  – AWWA C104 / A21.4
  – Standard or Double
  – Type I/II Portland Cement vs Type V
  – Purpose of cement – prevent tuberculation.
  – Life cycle of lining.

• Seal Coat – purpose

• NSF – 61 & NSF – 372 Standards
  – Safe Water Drinking Act

• Cement Lining vs Protecto 401.
  – Ph levels 4/5
  – Gravity line / Force Main
  – Force Main
    • Will the line be full 24/7
    • Air Release
• Cement Lining vs Protecto 401.
  – Ph levels 4/5
  – Gravity line / Force Main
  – Force Main
    • Will the line be full 24/7
    • Low flow / remote areas
    • Air Release

• Protecto 401 Ceramic Epoxy
  – Over 25 years of proven history – thousands of miles
  – Chemical / Abrasion resistant
PROTECTO 401 CERAMIC EPOXY

- Oxide Layer: 550-600 psi film strength
- Protecto 401 Adhesion: 1000 psi
- Corrosion by products for oxide: 1200-1400 psi
- Protecto 401 is NOT lifted by corrosion

Protecto 401 Lining film strength ~ 250-300 psi

Any lining with a film strength greater than the film strength of the oxide layer (>600 psi) will delaminate at exposed edge or pinhole.
PROTECTO 401 CERAMIC EPOXY

- Easy identified
- Protecto 401 – non-potable water only
- Field patch kits available for cuts etc.
PREVENTION

- Oxide layer
- Natural layer formed on the outside diameter of Ductile Iron pipe during the manufacturing process.
- Dis-bonded joints (rubber gasket)
- Tyton Joint cut out view:
BENEFITS OF V-BIO

• V-BIO 16 mils
  Polywrap 8 mils
• V-BIO – 3 layers of co-extruded material.
• V-BIO Inside surface is infused with an anti-microbial biocide which mitigates microbiologically influenced corrosion.
• V-BIO Volatile corrosion inhibitor to control galvanic corrosion.
• Meets ANSI / AWWA C105 / A21.5 Standard
**Method A**

In this method, which is preferred by most utilities and contractors, one length of polyethylene tube, overlapped at the joints, is used for each length of pipe.
POLYWRAP INSTALLATION

**Method B**

A length of polyethylene tube is used for the barrel of the pipe and separate lengths of polyethylene tube or sheets are used for the joints.

Note: Method B is not recommended for bolted-type joints unless an additional layer of polyethylene is provided over the joint area as in Methods A and C.
POLYWRAP INSTALLATION

Method C
Each section of pipe is completely wrapped with a flat polyethylene sheet.
INSTALLATION STEP 1 & 2
INSTALLATION STEP 3 & 4
INSTALLATION STEP 5 & 6
INSTALLATION STEP 7 & 8
INSTALLATION STEP 9
To perform the preferred method of tapping polyethylene-encased Ductile Iron pipe, wrap two or three layers of polyethylene adhesive tape completely around the pipe to cover the area where the tapping machine and chain will be mounted.
Mount the tapping machine on the pipe area covered by the poly ethylene tape. Then make the tap and install the corporation stop directly through the tape and polyethylene.
After making the direct service connection, inspect the entire circumferential area for damage and make any necessary repairs.
RE COURSES

• AWWA Standards
  – C104 A21.4
  – C105 A21.5

• DIPRA Publications
  – Corrosion
  – Polywrap

• McWane Ductile
  – Pocket Engineer
    • Product Info
    • Calculators
  – Modern McWane Magazine
    • Technical Articles
Questions?

- Jerry Regula
  - Product Engineer
  - McWane Ductile
  - Jerry.regula@mcwaneductile.com
  - 740-294-7899