

PRCI COATINGS RESEARCH



GREG RUSCHAU
CC TECHNOLOGIES
DUBLIN, OH

PRCI RECENT STRATEGY

- HAS SHIFTED FROM MAINLINE COATINGS TO REPAIR/REHAB COATINGS
- FIELD-APPLIED COATINGS ARE CURRENT FOCUS OF “PURE” COATINGS RESEARCH
- ASSESSMENT OF IN-SERVICE CONDITION VERY IMPORTANT
- VERY LITTLE FOCUS ON FUNDAMENTALS OF HOW, WHY COATINGS PERFORM
 - ALWAYS HAS BEEN FOCUSED ON RESULTS WHICH OPERATORS CAN USE

WHY THE STRATEGY SHIFT?

- OPERATORS FEEL THEY KNOW HOW TO SELECT PLANT-APPLIED COATINGS
- MOST ARE DEALING WITH OLD SYSTEMS OF COAL TAR AND ASPHALT ENAMELS WHICH NEED REPAIR OR REHABILITATION
- NO QA/QC STANDARDS FOR REPAIR COATINGS – UNCERTAIN INTEGRITY

RECENTLY COMPLETED (SINCE 2000) PRCI PROJECTS RELATED TO COATINGS

- Performance of Blistered FBE Coating (2000)
- Development of Predictive Accelerated Test Methods for Pipeline Coatings (2002)
- Compatibility of Repair Coatings to Existing Below Grade Pipeline Coatings (2002)
- Coating Repairs for Thermite Welds and Keyhole Excavations (2003)

PERFORMANCE OF BLISTERED FBE COATED PIPE

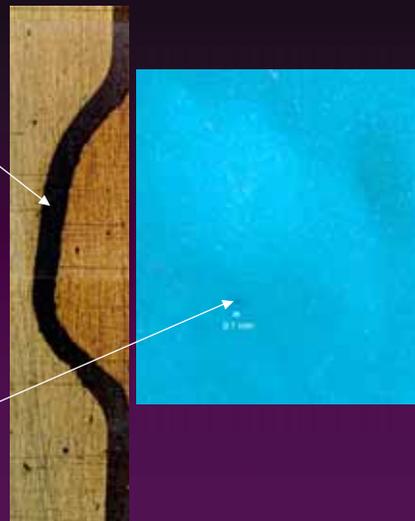
• WHEN FBE COATED PIPE IS UNCOVERED AND THERE ARE BLISTERS, WHAT SHOULD BE THE REMEDIAL ACTION? RECOAT, INCREASE CP, LEAVE ALONE?

• DOES FBE COATING REALLY ALLOW CP TO PENETRATE?



RESULTS/CONCLUSIONS

- BLISTERS FORMED AT HIGH TEMPERATURES ($>T_g$) DID NOT PASS CP CURRENT
- BLISTERS FORMED AT LOW TEMPERATURES WILL ALLOW CP CURRENT, BUT LIKELY BECAUSE OF MICROCRACKS



DEVELOPING ACCELERATED PREDICTIVE TEST METHODS FOR EXTERNAL PIPELINE COATINGS

Develop laboratory testing for FBE pipeline coatings which is:

- Accelerated to provide answers in a short time frame
- Predictive of future performance
- Realistic in that it accentuates the degradation of properties which are likely to degrade in service

APPROACH

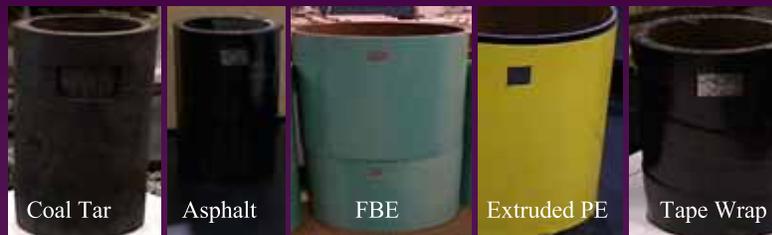
- CATALOGUE FIELD FAILURES AND FOCUS ON TESTS WHICH PRODUCE THESE FAILURES
- USE SUITE OF TESTS RATHER THAN SEARCH FOR “MAGIC” ANSWER
- INVESTIGATE ANALYTICAL TECHNIQUES FOR POTENTIAL BREAKTHROUGHS

RESULTS / CONCLUSIONS

- Field failure pattern was common: Isolated pockets of blisters and adhesion loss
 - Blisters associated with cathodic disbondment
 - Localized failures from poor surface prep/application
- Scatter in test results from differently prepared FBE samples was greater than between different products
 - true comparative performance testing can only be done on samples with identical surface preparation
- For coating selection, several accelerated test techniques provide “scoring system” type protocol

COMPATIBILITY OF REPAIR COATINGS TO EXISTING BELOW GRADE PIPELINE COATINGS

- Determine chemical compatibility of *selected* repair coatings to mainline coating
- Describe general chemical compatibility of different chemistries of coating systems



CONCLUSIONS FROM PROJECT

- Epoxy mainline coatings provide best chemical surface for bonding – epoxy and epoxy polyurethane repairs both excellent
- Thermoplastic coatings (asphalt, coal tar enamel, PE tapes, extruded PE) provide only physical surface for bonding
 - Only in a molten state can the repair coatings bond with the mainline coatings
- Short term chemical aging failed to significantly affect performance ranking in any systems

COATING COMPATIBILITY AT THERMITE WELDS AND FOR KEYHOLE EXCAVATIONS

- For special pipeline excavations involving thermite welds and other anode connections
- The requirements for achieving an acceptable coating repair at these excavations differ from standard bellhole survey repairs



APPROACH

- Lab – look at adhesion to different components
- Simulation of keyhole application

RESULTS/CONCLUSIONS

- Adhesion to insulation is weakest link – PVC insulation better than Polyethylene for this application
- Epoxies have superior compatibility and adhesion, most also apply easy
- For application ease, best combination is a moderately thick viscosity and rapid drying time (not necessarily rapid cure time)

CURRENT PRCI COATING PROJECTS AT CC TECHNOLOGIES

- Cathodic Protection Shielding of Girth Weld Coatings
- Effects of Surface Preparation on the Performance of Repair and Rehabilitation Coatings
- Performance of Coatings Applied to Wet Surfaces
- Effective Methods of Coating Removal During Investigative Excavations
- Assessment of Aboveground Techniques for Locating Coating Defects (OPS co-funding)

COMMENTS ON CURRENT STATE OF PIPELINE COATING TECHNOLOGY

- **PIPELINE INDUSTRY HAS VERY LIMITED FUNDAMENTAL UNDERSTANDING OF THE TECHNICAL ISSUES WITH COATINGS**
- **COATINGS ARE FORMULATED TO PASS PERFORMANCE TESTS RATHER THAN TO PERFORM IN THE FIELD (IS IT THE SAME?)**
- **COATINGS ARE CONSIDERED A COMMODITY PRODUCT, NOT MATERIALS SCIENCE**
 - **NOT AS COMPLEX AS ALLOYS, SMART PIGS, INSPECTION TOOLS**