Highlighted Programs from NYSEARCH

Cased Pipe RD & D Activities

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Background

- Currently, no single technology can meet the need to inspect cased crossings for pipelines that cannot be pressure tested or ILI,

- Engineers are looking for ways to address rule:
  - best practices
  - new technologies
  - formalized/approved decision-making

- In most cases, members have carrier pipes that are:
  - coated,
  - cathodically-protected,
  - electrically isolated from surrounding metallic casing

NYSEARCH Projects

- Several Guided Wave Technology Development, Testing and Demonstration Projects
- Multi-Technology Testing and Validation of Technologies for Cased Pipes
- NYSEARCH Robotic Inspection Platforms and Sensors
- Mini-Camera for Inspection of Carrier Pipe via Annular Space
- Cased Pipe Risk Assessment Model
- Test Program Evaluation of TransKor Remote Inspection Using Magnetic Tomography

Cased Pipe Risk Model – NYSEARCH, WKM & CCT Project Vision

- Collect historic data on cased crossings
- Through contractor, pool data among participating companies
  - Separate carrier pipes in casings into different bins
    - those with known shorts (both electrolytic & metallic)
    - those with atmospheric corrosion (only possible thru casing vents)
    - those with information such as CP history
    - those with gaps in CP history or no information
- Develop decision-tree analysis & spreadsheet
- Options
  - Integrate into existing risk assessment software
  - Develop technical document for submission to NACE

Specific Threats by Category

Category	Example
Time Dependent	External Corrosion, Internal Corrosion, SCC, Erosion, Fatigue
Static or Resident	Manufacturing, Welding/Fabrication, and Equipment Defects
Time Independent or Random	Mechanical Damage, Incorrect Operations, Weather and Outside Forces

PHMSA ‘Serious’ Incident Data

- Avoidance of threats (gas transmission)
  - Third party damage (34.4% of all incidents)
  - Other external forces plus natural forces (4.6%)
  - Material failure (10.6%)
    - some of these would be avoided since activation requires external force
- Cased pipe might be ~40% lower PoF than uncased

Estimate Probability of Failure

- Use risk principles to evaluate threat
  - Avoid unnecessary assessment

- Utilize three concepts for PoF
  1. Exposure (corrosivity) = *likelihood of an active pipe failure reaching the pipe when no mitigation applied*

  2. Mitigation (CP and Coatings) = *reduces likelihood or intensity of the exposure reaching the pipe; keeps mechanism off the pipe*

  3. Resistance (Pipe Wall Thickness/SMYS) = *ability to resist failure given presence of exposure/threat*

- Probability of Damage (PoD) determined by #1 and #2
- Probability of Failure (PoF) determined by PoD and #3

- Risk = PoF x CoF

(Most work to date has been on PoF)

Estimate Consequence of Failure

- Risk = (PoF)·(Consequence)
- Consequence of Failure
  - Estimate of hazard area
  - Estimate of damages (property, people, etc)
- Consider leak vs. rupture
  - Stress comparison (operating pressure vs. failure pressure)
  - Benefit of casing (including leak monitoring)

Risk Categorization – Applicability of Risk Model

1. Low Risk
   - Risk insignificant
2. Susceptible
   - Work to put casing in ‘Low Risk’ category
     - Collect additional data to determine if categorization is from uncertainty (i.e., conservative assessment was assumed)
     - Perform action to stop atmospheric or external corrosion
     - Mitigate or eliminate corrosive environment
       - e.g., remove short, dry annulus and repair end seals, use dielectric wax
3. At risk
   - Examine or inspect pipe
   - Possible repair
   - Possible P & M measures
   - Mitigate or eliminate corrosive environment

Regulatory Context – Options to Remove Threat

1. Simple flowchart to rank casings
2. Remove external corrosion (EC) threat on basis of low EC likelihood (PoD)
3. Remove external corrosion (EC) threat on basis of low EC damage (PoF)
4. Remove casing threat on basis of low overall risk

Cased Pipe Risk Model
Project Objective & Deliverables

- Objectives
  - Phase I
    - To develop an overall risk assessment algorithm to support risk and integrity management of cased pipeline installations
  - Supplemental Work
    - Address areas in model that have been identified as needing strengthening for model durability and usability
    - Conduct user discussions and evolve acceptance and implementation of model
  -

- Phase I Deliverables – STATUS –COMPLETE 7/08
    - Spreadsheet that incorporates risk assessment algorithms
    - User Manual

Remaining Work for Cased Pipe Risk Model

- Continued User Validation
- Casing Assessment being harmonized with all HCA assessments
- Determination of what database software to convert spreadsheet into
- In order to focus time, funds and energy on “at-risk” segments, discuss and evolve to “thresholds” of risk and acceptable level of risk management

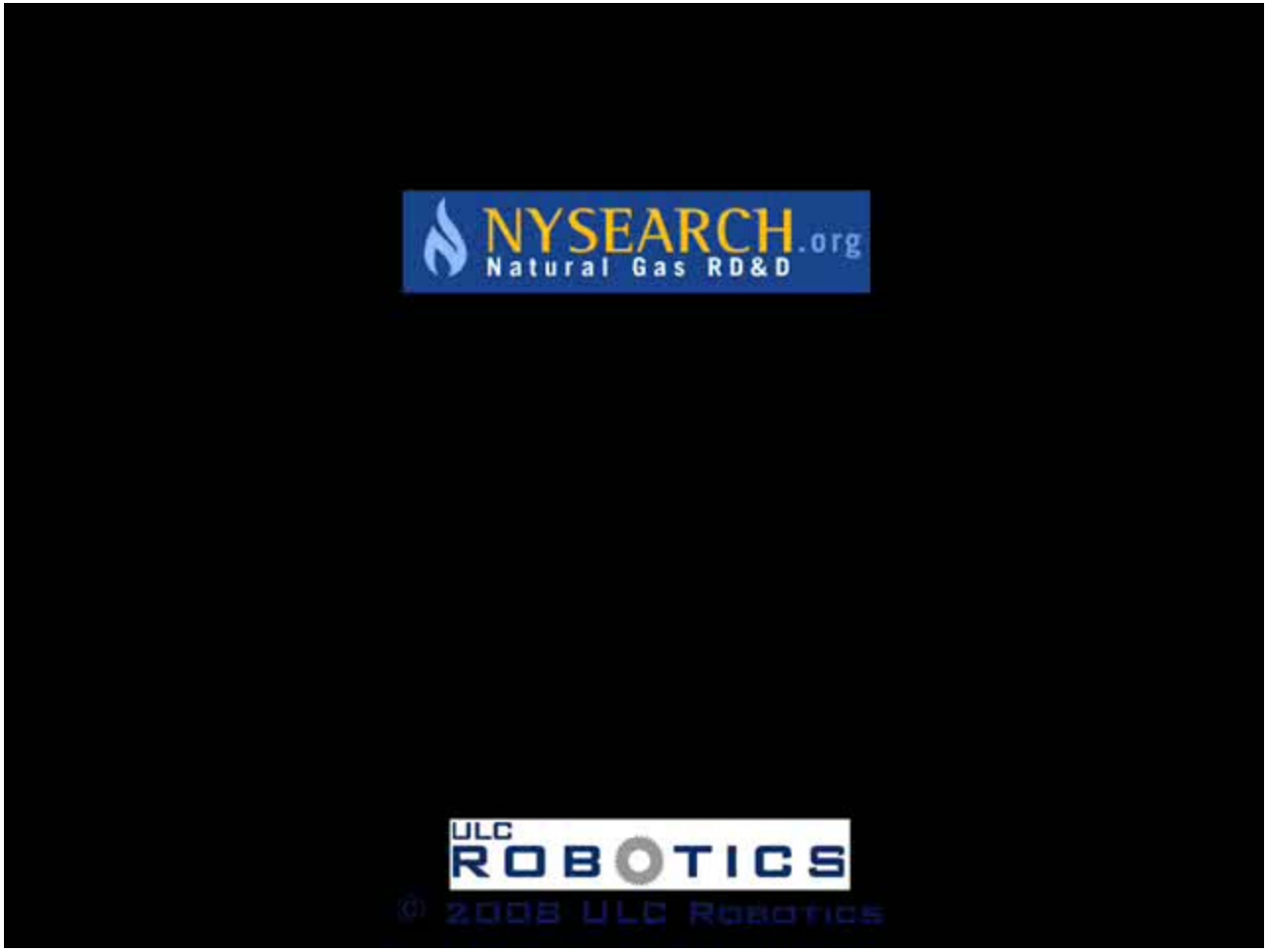
Next Steps for Cased Pipe Risk Model

- Continue to discuss Funders' individual experiences with validation of initial model
- Initiate and complete Supplemental work
- Broaden dialogue on application and implementation of model with industry and regulators
- Discuss and determine whether further, formal validation is warranted and supported

NYSEARCH-ULC Robotics Mini-Camera Project

- Purpose: To develop a platform for inspection of the carrier pipe in the annular space
- Phase I: Development, testing and implementation of visual inspection camera
- Video Inspection can provide data regarding
  - Integrity of Coating
  - Physical placement and condition of insulators
  - Presence of Electrical contacts
  - Environmental Conditions
  - Risk Assessment
- Phase II is intended to add moisture sensor & NDE sensing capability

Video of Live Job Using NYSEARCH/ULC Robotics Prototype Mini-Camera



Summary

- Important options such as risk model and mini-camera are becoming available and can serve to enhance other technology options
- NYSEARCH has been addressing gaps and evaluating novel technologies
- NYSEARCH's voluntary program has had high subscription by companies with R & D funds. Pipeline Integrity engineers have been very active in these projects
- NYSEARCH is looking for common dialogue among LDCs, industry as a whole and regulators on effective applications of various technologies for cased pipes