High Pressure Internal Rehabilitation
“HPIR” Class
Composite Pipeline System

CRUG Conference, Houston TX

September 25, 2015
Smartpipe®
HPIR Class Pipeline Overview

Manufactured on site using portable factory
16” Smartpipe® Sample
Portable Factory
Technical Advantages

- Portable Factory On-site
- Long Pull lengths
- Forming Compact C-shape
The Environmental Solution

Protect Native Species

Smartpipe® can be installed as a HPIR class installation inside a corroded pipeline without the need to disrupt the habitats of native species, avoiding lengthy Environmental Impact Studies.

Continuous Pull

The Smartpipe® design includes high strength longitudinal pulling tapes, which allow the Smartpipe® system to be installed in very long continuous lengths, of up to several miles, without the need for intermediate couplings.

High Strength Design

With a maximum operating pressure of up to 1,000 psi, Smartpipe® design exceeds current industry standards requirements, is fully structural and can be laid as a direct burial or inside an existing corroded pipeline.
Optimal for Congestion

Smartpipe® is especially suited to right-of-ways with multiple pipelines, that are considered highly congested. Minimal access is required to the existing pipeline so excessive excavations are not required.

Replace Corroded Pipelines

Smartpipe® is a composite pipeline system that is non-metallic and, once installed, eliminates the requirement for corrosion control and excessive pigging.

Fiber Optic Monitoring & Communication

The Smartpipe® embedded fiber optic monitoring system instantly identifies and locates a leak or movement in the pipeline to within one meter, with notification sent to a SCADA system, pipeline control room and with data sent directly to a Smart Phone.
The Urban Solution

Efficient Installation

Using the portable manufacturing and installation system, Smartpipe® HPIR class installations are replaced at approximately one mile per day with a small crew and equipment footprint.

Trenchless Technology

A Smartpipe® HPIR class replacement allows corroded pipelines to be safely replaced without the need to access the complete right-of-way.

Non-Intrusive

Smartpipe® pipeline replacement projects require minimal excavations, avoiding the need for long trenches with public and environmental disruption.
HPIR Class Composite Pipeline
Value Proposition

- Fully Structural Composite Transmission Pipeline
- Non-Corroding
- Reduced carbon footprint compared to traditional steel
- Continuously Monitored by Latest Fiber Optic Technology
- High Pressure
- Large Diameter – Presently 6” to 16”
- Long Continuous Lengths Between Connectors
- Difficult or Impossible to Access Locations
- Very Cost-Effective to Install and Operate
Smartpipe® HPIR Class Composite Pipeline Development

12,000 sq. ft  State of the Art R&D Facility – Houston, Texas
Testing Operations

Testing Bays and Prototyping Machine

Control Room
Elevated temperature test bay with Long Term Stress Regression Samples at 80°C
**Standards and Codes**

**Standard Specification for Reinforced Polyethylene Composite Pipe For The Transport Of Oil And Gas And Hazardous Liquids**

- Designation: F2896 – 11
- Standard issued under the format designation F2896; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reaffirmation. A superscript epsilon (ε) indicates an editorial change since the last revision or reaffirmation.

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**API 15S Ballot Summary Sheet**

- **Ballot:** Spec 15S Reballot
- **Start Date:** 2/12/15
- **Closing Date:** 4/9/15
- **Ballot #:** 3458
- **Associate:** Benjamin Coco
- **Coordinator:** Benjamin Coco

**Voting Category**

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<th>Negative</th>
<th>Abstain</th>
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<tr>
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US State Waivers

STATE OF ILLINOIS

ILLINOIS COMMERCE COMMISSION

Northern Illinois Gas Company d/b/a Nicor Gas Company

Application for Waiver of 49 CFR Sections 192.53(c), 192.121, 192.122, and 192.191(h) of the federal Rules governing intrastate gas distribution pipeline segments that cross a river approximately one mile southeast of Ottawa, Illinois.

By the Commission:

I. Introduction

On March 14, 2011, Northern Illinois Gas Company d/b/a Nicor Gas Company filed its Application for Waiver ("Nicor Gas" or the "Company") seeking an order granting Nicor Gas a waiver of 49 CFR Sections 192.53(c), 192.121, 192.122, and 192.191(h) to permit the installation of non-metallic, composite, reinforced thermoplastic pipe ("RTPI" or "Smart Pipewall") for rehabilitation of up to four 42-inch steel intrastate gas distribution pipeline segments that cross a river approximately one mile southeast of Ottawa, Illinois. The Commission entered an Interim Order (the "Interim Order") on September 30, 2011, allowing the Secretary to review and object to the waiver, pursuant to the Interim Order of the Department of Transportation, with a copy to the Association for Pipeline Safety and the Pipeline and Hazardous Materials Safety Administration ("PHMSA") and to the Regional Director of PHMSA's Central Region, to allow the Secretary to review and object to the waiver, pursuant to the Interim Order of the Department of Transportation.

II. Applicable Rules and Company's Position

The Commission has adopted the standards for pipeline safety found in 49 CFR Section 192.53(c), 192.121, and 192.191(h), including the subject of Nicor Gas Application, as its minimum safety standards. The standards require that gas distribution pipeline segments be designed to withstand internal or external design pressures and that pressure testing be conducted to confirm the integrity of the pipeline. The standards also require that pipeline segments be inspected to verify compliance with the applicable rules.

The Company has submitted an Application for Waiver seeking a waiver of the requirements of 49 CFR Section 192.53(c), 192.121, and 192.191(h) to permit the installation of non-metallic, composite, reinforced thermoplastic pipe ("RTPI" or "Smart Pipewall") for rehabilitation of up to four 42-inch steel intrastate gas distribution pipeline segments that cross a river approximately one mile southeast of Ottawa, Illinois. The Commission entered an Interim Order (the "Interim Order") on September 30, 2011, allowing the Secretary to review and object to the waiver, pursuant to the Interim Order of the Department of Transportation.
The fiber is the sensor

Measurements all along a 10km fiber = 10,000 sensors

Standard multi- or single-mode optical fiber

Measurement point every 1m

1-10m pulse
Direct Benefits

- Prevention of a Major Disaster
  - Potential Loss of Life, Environmental Damage & Cleanup Costs
  - Penalties, both Civil & Potentially Criminal
  - Damage to the Company’s Reputation
  - Loss of Shareholder Value

- Continuous Monitoring and Communication System:
  - Detects nearby threats, i.e. backhoe, etc.
  - Notifies the operator immediately
  - Identifies the leak or impact location within 1 meter
Direct Benefits (Cont..)

- Resistance to 3rd Party Damage & Ground Movement
- Double Barrier in High Consequence & Environmentally Sensitive Areas
- Lower long-term maintenance costs
- Reduced environmental footprint from traditional steel pipelines
Illinois River Crossing

- Two 6” x 2,500 Feet Pipelines
- Natural Gas
- MAOP – 230 psi
Cushing, OK

- 10” @ 270 psi
- Crude Oil
- Estimated length 4,560 feet
Bakersfield CA
Endangered Species on Pipeline Right-of-Way

San Joaquin kit fox
*Vulpes macroticus mutica*

San Joaquin antelope squirrel
*Ammospermophilus nelsoni*

Western burrowing owl
*Athene cunicularia*

Giant kangaroo rat
*Dipodomys ingens*

Blunt-nosed leopard lizard
*Gambelia sila*

Kern mallow
*Eremalche parryi ssp. kernensis*
Canadian Hydrogenics Pilot Project

Hydrogenics and Enbridge consortium with Smartpipe®
Smart Pipe Company, Inc.

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