SCAP

COLLECTION SYSTEMS COMMITTEE MEETING

Trenchless Mechanical Spot Repairs

Tuesday – March 29, 2016 – Irvine, Ca.

Presented by: Dave Badgley – Badgley & Assoc.

Representative for:

Pipeline Rehab.	Maintenance Hole Rehab.	Odor Control
PACIFIC MULTILINING	Cretex Specialty Products	Vortex Flow ODOR & CORROSION CONTROL
SnapTite	TERRE HILL COMPOSITES	
HydraTech ENGINEERED PRODUCTS	SEWPERCOAT	WAGER COMPANY
PIPE ROBOTEC	Kerneos ALUMINATE TECHNOLOGIES	
INFRA-TECH		

What we are going to cover

- Where Can Spot Repairs be Used
- Pipeline Problems
- Evolution of sewer spot repair technology
- Large Diameter (Man Entry) Pipelines 18 & Larger
- Small Diameter (Robotic Access) Pipelines 8-24
  - Spot repairs
  - Offset sealing
  - Pipeliner end seals
- External pipeline repairs

Dig & Replace Applications

Deteriorated Bottoms

Protruding Laterals

Severe Offsets over ¾“

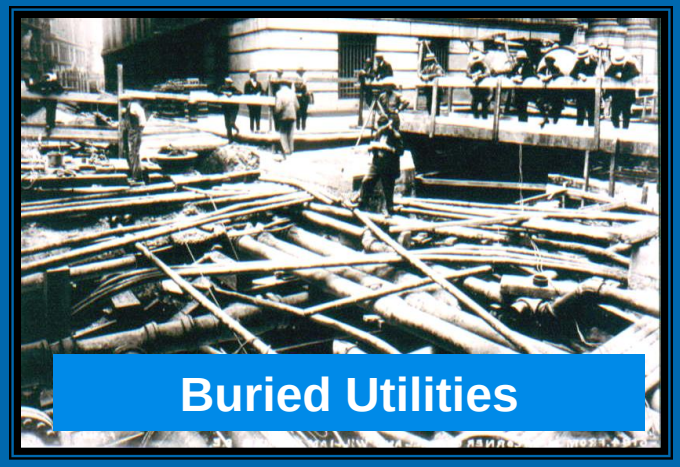
Crushed Pipe

Gas Line Bored Trough

Traditional Dig & Replace Problems

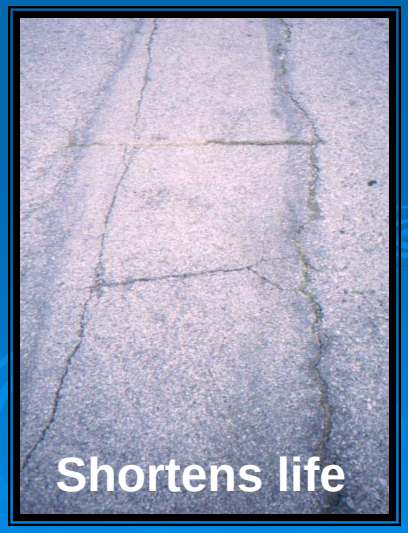

Traffic Disruption

Business Disruption


Buried Utilities


Broken gas lines


Broken phone cables


Shortens life of pavement

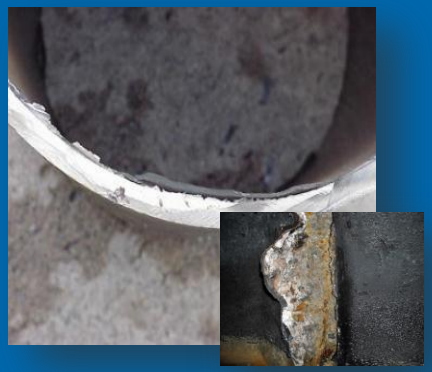
Dig & Replace

Advantages

- Structural Repair / damaged section only
- Correct misalignments

- Disadvantages
  - High cost
  - Access limitations
  - Roots may grow back
  - Disruptive
    - Traffic
    - Private property damage
    - Can lead to Unlimited costs – Change orders

Trenchless Spot Repair Applications



Coating Failures

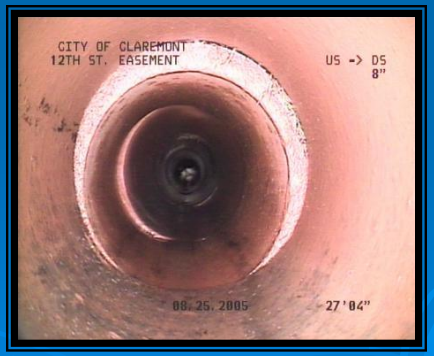
Bored Gas Lines

Capped Lateral Connections

Infiltration

Liner Failurers

Mineral Deposits



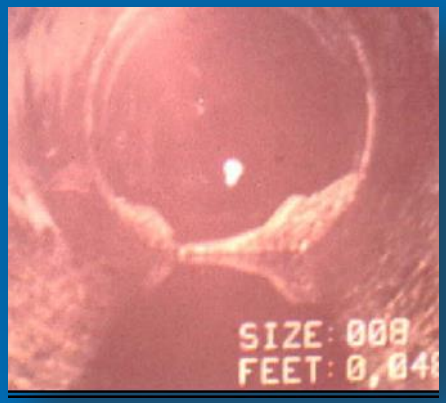
Offsets <3/4”

Holes

Classic Pipe Joints

Top of Pipe Joint Grouted

Tar Joints



Grout in joint

Bottom of pipe joint
No grout

PVC Joint - 1960

Infiltration Cost Savings

Treatment Cost $1.00 per 1000 Gallons of Water

Leak Rate	Gallons Per Day	Annual Cost 1 Joint	Annual Cost 5 Joints	Annual cost 10 Joints
1 GPM	1,440	$526.00	$2,628.00	$5,260.00
5 GPM	**7,200**	**$2,628.00**	$13,140.00	$26,280.00
10 GPM	14,400	$5,256.00	$26,280.00	$52,560.00
20 GPM	28,800	$10,512.00	$52,560.00	$105,120.00

Water Loss - Leaking joints EPA Report

EPA United States Environmental Protection Agency

WATER AUDITS AND WATER LOSS CONTROL FOR PUBLIC WATER SYSTEMS

The Water Loss Problem

Public water systems face a number of challenges including aging infrastructure, increasing regulatory requirements, water quantity and quality concerns and inadequate resources. These challenges may be magnified by changes in population and local climate. It has been estimated that:

- The United States. will need to spend up to $200 billion dollars on water systems over the next 20 years to upgrade transmission and distribution systems.[i]
- Of this amount, $97 billion (29 percent) is estimated to be needed for water loss control.[ii]
- Average water loss in systems is 16 percent - up to 75 percent of that is recoverable.[ii]

Average Water Loss is 16% - up to 75% of that is recoverable

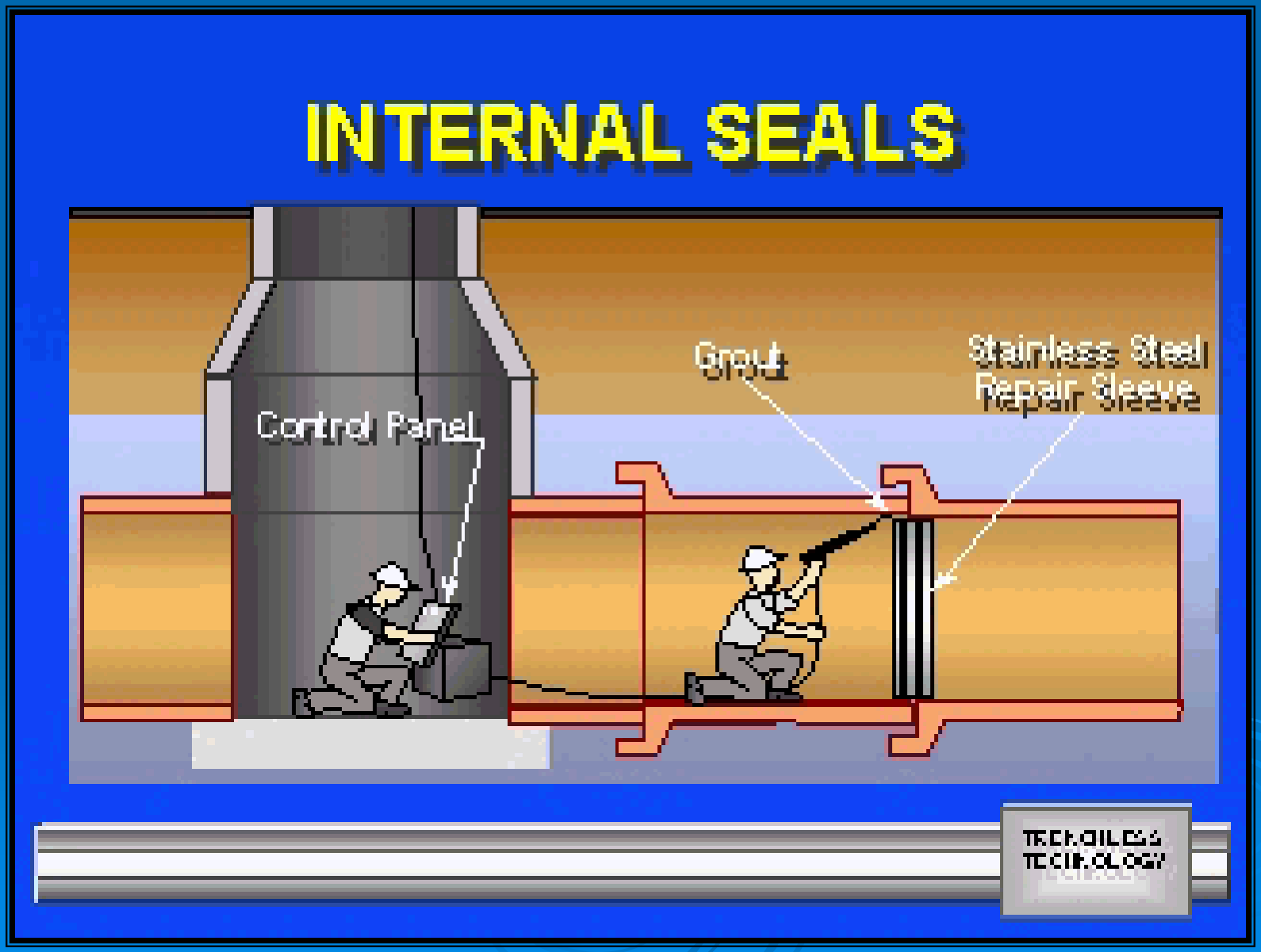
History of Trenchless Pipeline Rehabilitation

- **1960 Chemical Grouting**
- **1970 Continuous HDPE Sliplining**
- **1980 Cured-in-Place**
- **1990 Segmented Sliplining**
- **1990 Folded-and Reformed**

Trenchless Spot Repairs

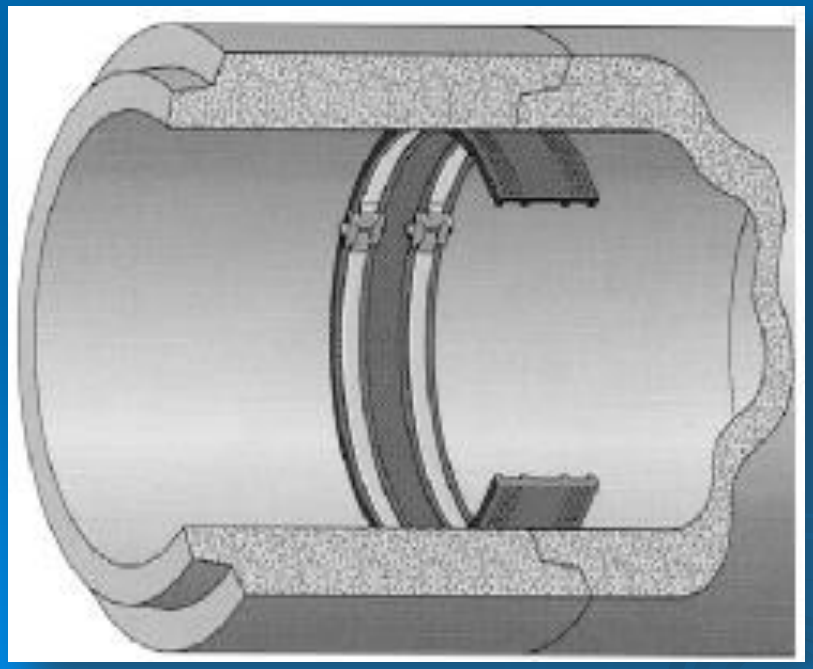
- ***Chemical Joint Sealing***
- ***Mechanical Spot Repairs first generation***
- ***CIPP Trenchless Spot Repair***
- ***Mechanical Trenchless Next generation***
  - ***Large Diamater 18 – 180 inch***
  - ***Small diameter 6 - 18 Inch***

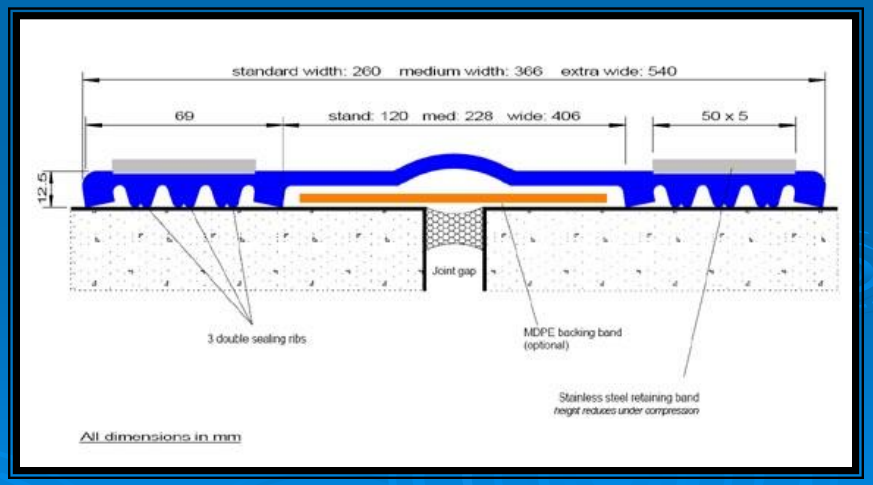
1976 Large Diameter 18” & Larger



Large Diameter Internal Joint Seal For open Joints & failing coatings

- A mechanical system that seals across open joints to prevent leaks or eliminate infiltration at pipe joints





Installation of Internal Joint Seals

Rubber Seal

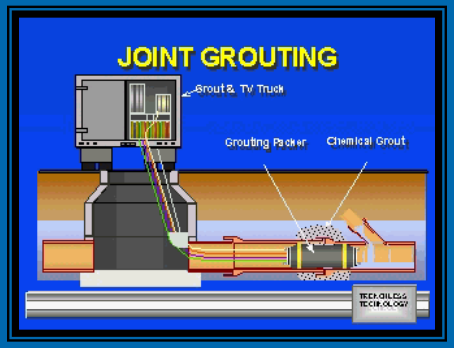
Installation Tool

Installation

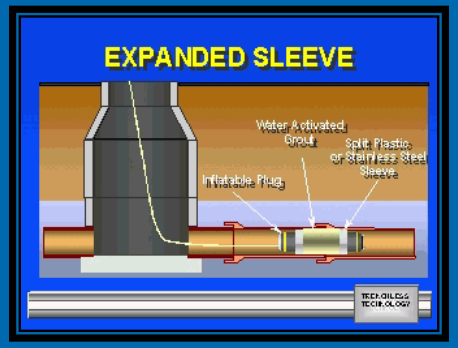
Installed Seals

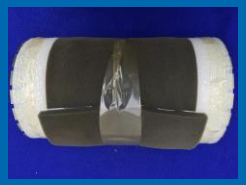
Evalution of Spot Repair Systems

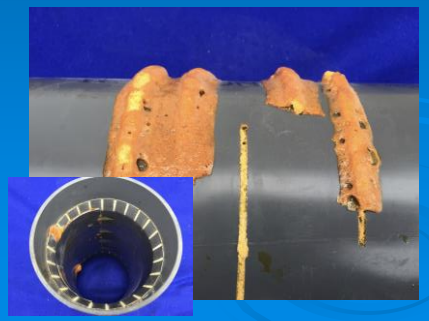
1960



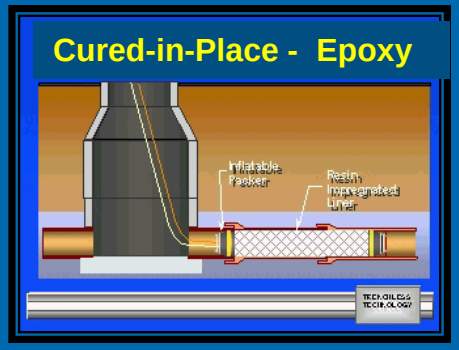
1980



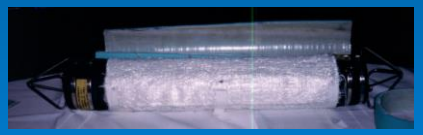




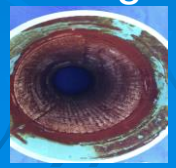
1993



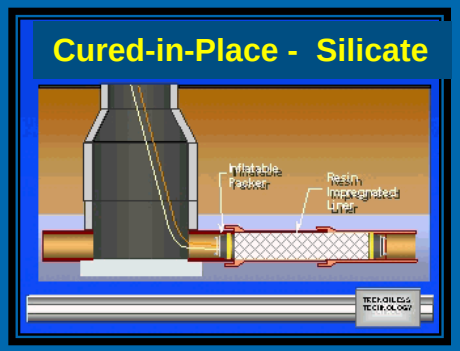
Inversion Style
CIPP Felt
Polyester Resin

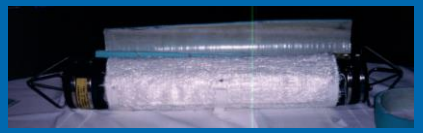


Burrito Wrap Style
Fiberglass & Epoxy



2004





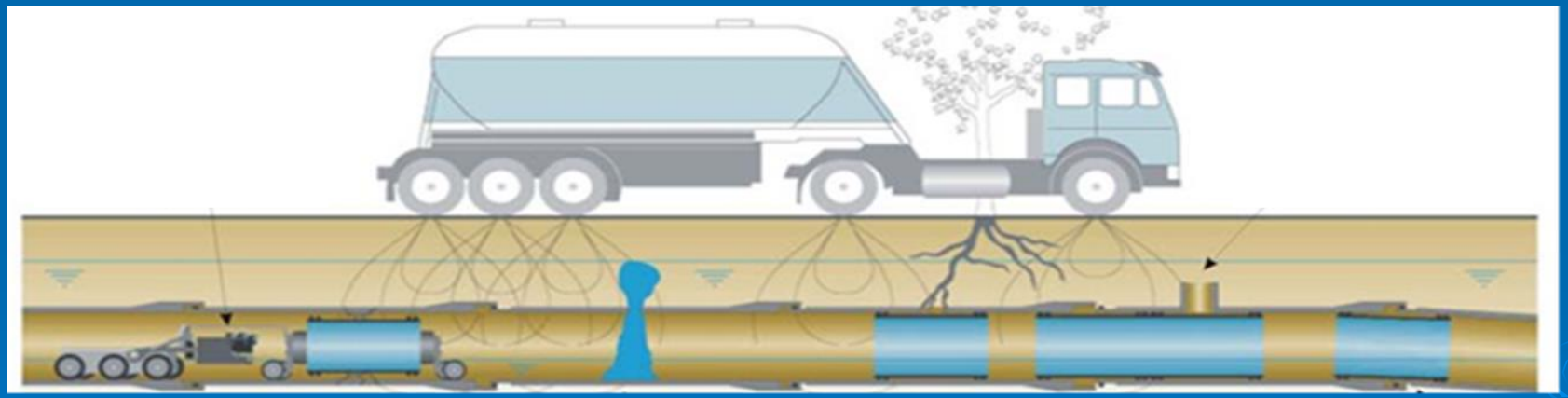
Burrito Wrap Style
Fiberglass
Silicate Resin

Small Diameter Spot Repairs

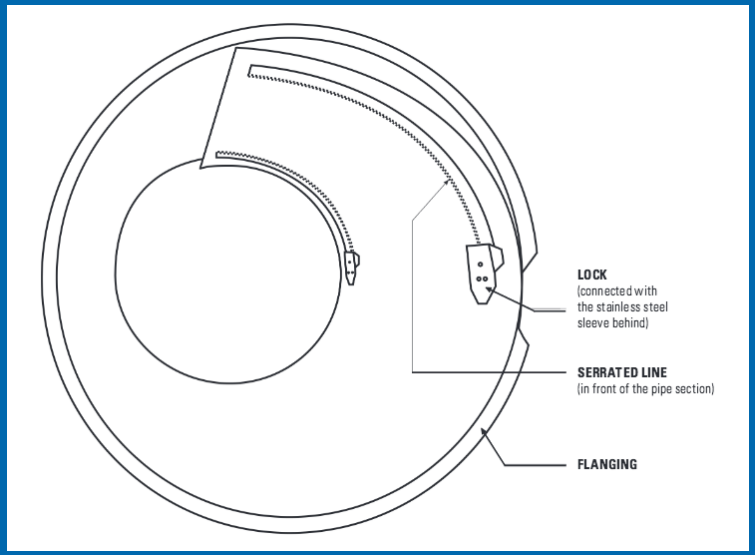
Spot Repair

Offset Repair

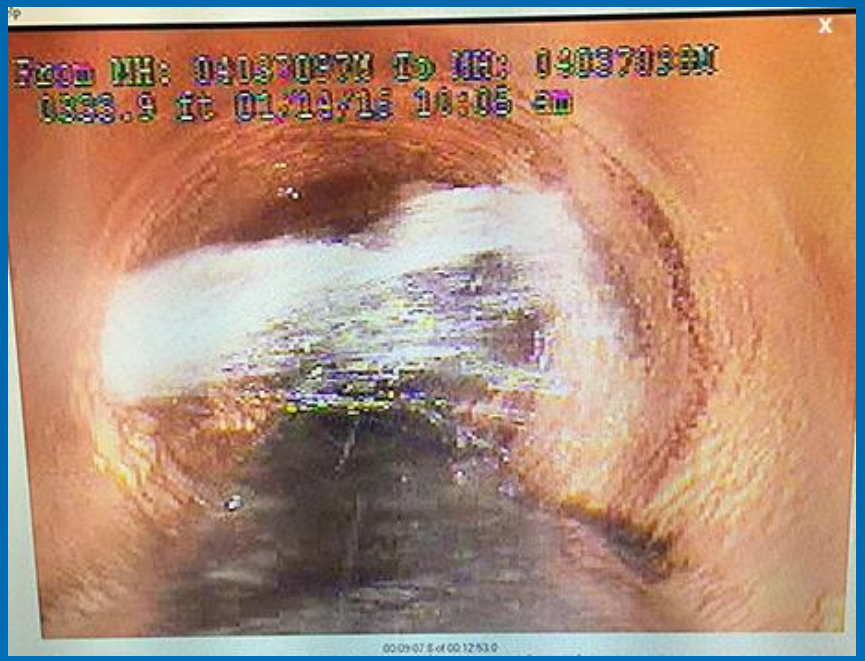
Pipe Liner End Seal



Pipe-Seal-Fix



Infiltration



Pre lining 10:05

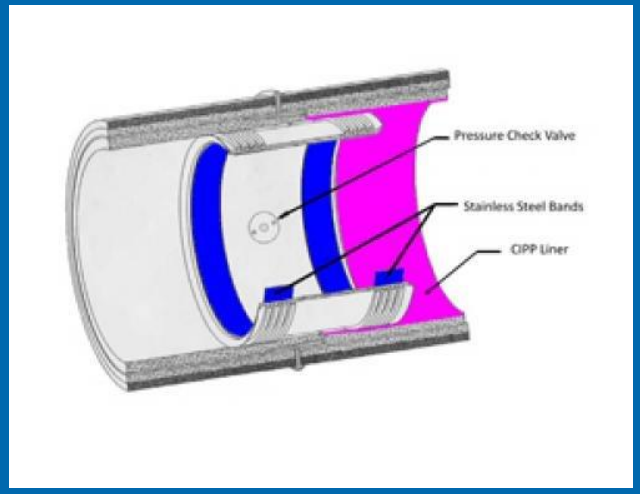
Post lining 12:47

Pipe Liner End Seals

End seal not installed

Poor Quality Workmanship

Mechanical End Seals



Pipe-Seal End 8” – 32”

Large Diameter 18” and Larger

Pipe-Seal-Flex

Corrects misaligned and off-set joints 8 - 18

EPA Emerging Technology

North American Society for Trenchless Technology (NASTT)
NASTT's 2016 No-Dig Show

Dallas, Texas
March 20-24, 2016

WM-T2-04

Testing and Performance Evaluation of an Internal Pipe Sealing System

Shaurav Alam, Trenchless Technology Center, Ruston, LA
Wendy Condit, Battelle, Columbus, OH
John Matthews, Pure Technologies, Baton Rouge, LA
Ariamalar Selvakumar, U.S. EPA, Edison, NJ

Field Testing

Figure 3. Installation at the Downstream Manhole

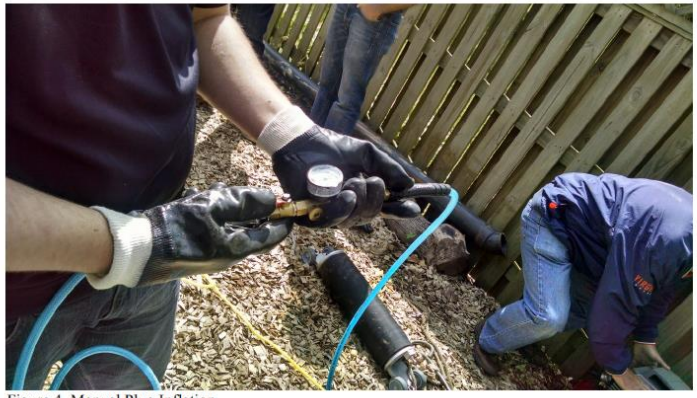


Figure 4. Manual Plug Inflation

Lab Testing

Figure 8. Test Setup – Positioning the Sample and Tube Inside a Larger Diameter Pipe

Water pressure was applied on the specimens and the specimens were found to hold 15 psi pressure (which is twice the design pressure) for approximately 150 minutes each with no leaks observed. For Specimens #1 and #2, minor leaks were found around the inflatable tubes that were part of the testing apparatus, which were regulated by increasing the water supply pressure. No leaks were observed in the inflatable tubes for the Specimen #3 indicating optimization of the test setup (see the constant pressure achieved in Specimen 3 in Figure 9). Next, Specimen #2 was prepared for an external hydraulic test that would take the seal to failure conditions in order to determine the maximum external hydraulic pressure. The seal broke at approximately 65 psi, although it is designed for 7.25 psi (see Figure 10).

5. TECHNOLOGY EVALUATION

In addition to the field demonstration, the system was also tested in the laboratory through the ability of the seal to resist external hydrostatic pressure on three test pipes consisting of 8-in diameter, unlined steel. The tests conducted did not simulate applying the sleeve over a defect in CIPP lined pipe, which could be a consideration for further study. Steel mechanical tubes were cut into 12-inch by 8-inch pieces and then tack welded simulating a crack or defect that spanned the circumference of the pipe. The resulting gaps were measured around the circumference of the pipe and averaged 0.25, 0.32, and 0.34 inches for pipes 1, 2, and 3, respectively (Figure 6). The repair was then performed on each of the three pipes and subjected to external hydraulic testing up to 15 psi. In addition, one specimen was taken to failure to observe the maximum external pressure that could be withstood.

Figure 6. Measurement of the Annular Gaps

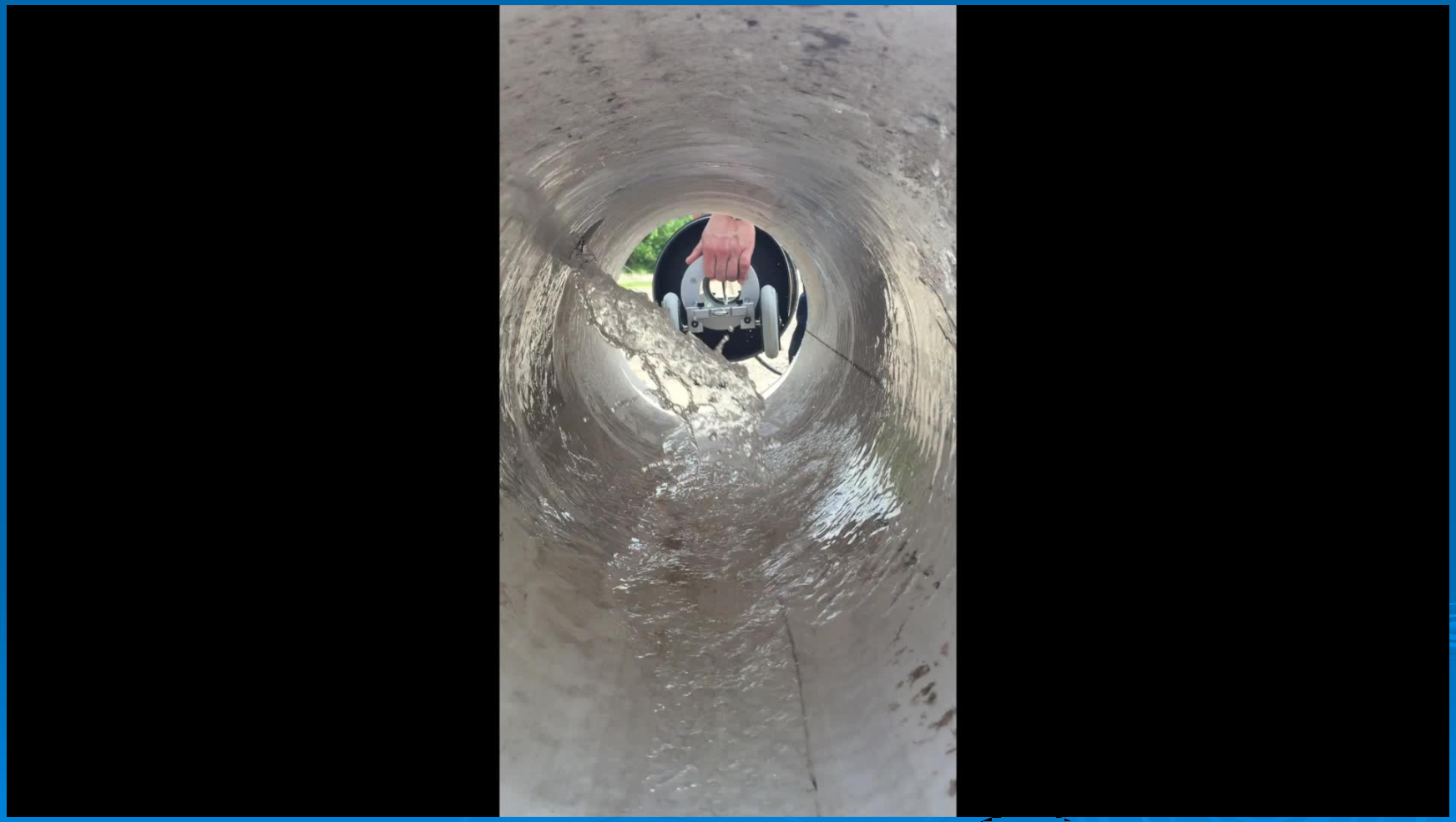
Conclusion

6. CONCLUSION

The laboratory evaluation of the internal pipe sealing system verified an external pressure of 15 psi was withstood with no leaks (approximately twice the design pressure of 7.25 psi) over 2.5 hours. The field demonstration of the internal pipe sealing system encountered some challenges, which prevented the robotic installation aspect of the technology from being fully observed. The issues were primarily related to access issues for the packer system in the pipe which had an offset in the CIPP-lined host pipe downstream. Also the limited size of the manhole upstream resulted in the need for the seal to be manually placed. The installation was completed in approximately three hours from site preparation to final CCTV inspection. The project had a negligible carbon footprint as the equipment required for the installation was minimal. The technology shows promise as a low-cost and rapid trenchless repair approach. However, access requirements should be assessed based upon site-specific conditions to ensure feasibility of the robotic-assisted installation, especially in previously lined pipes. If possible, the initial CCTV inspection should be completed with the packer assembly and/or a simulated pig of similar dimensions to ensure that bends and offsets can be successfully navigated.

Video Training Graphic

Infiltration Test Installation 1:07



Questions or Comments?

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