

CURED-IN-PLACE LINERS (CIPL) PROJECT WORKSHOP

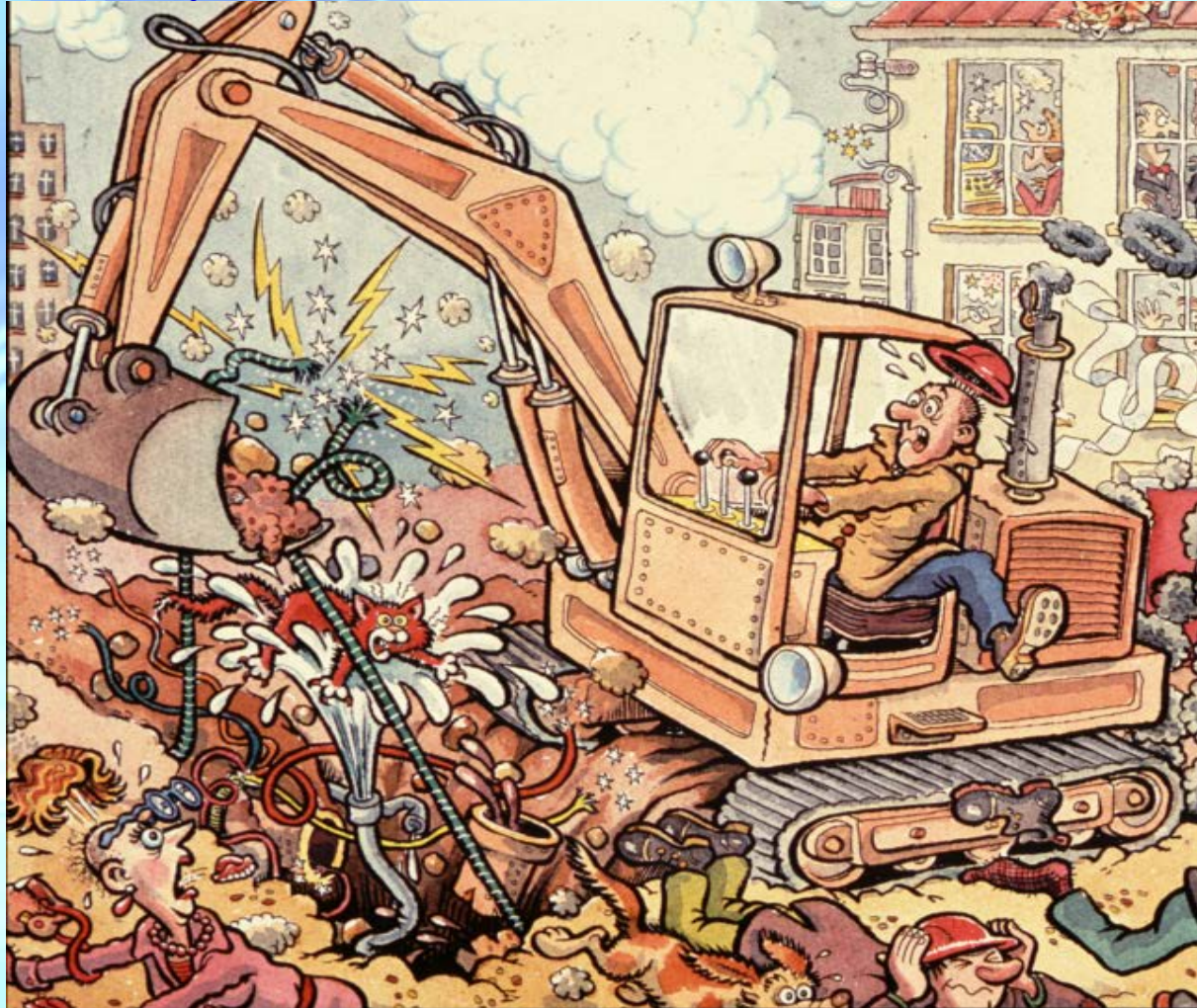
**The Roosevelt Hotel
NYC, NY
August 20, 2015**



UTILITY CONSTRUCTION CONTINUES TO CHANGE.....



BUT...MORE CHANGE IS NEEDED!



HISTORY CIPL

- **1983 – CIPL Japan study increases seismic durability**
 - 5 cm axial deformation
 - 10° snap angles
- **820 miles Paltem installed worldwide**
- **Continued usage**

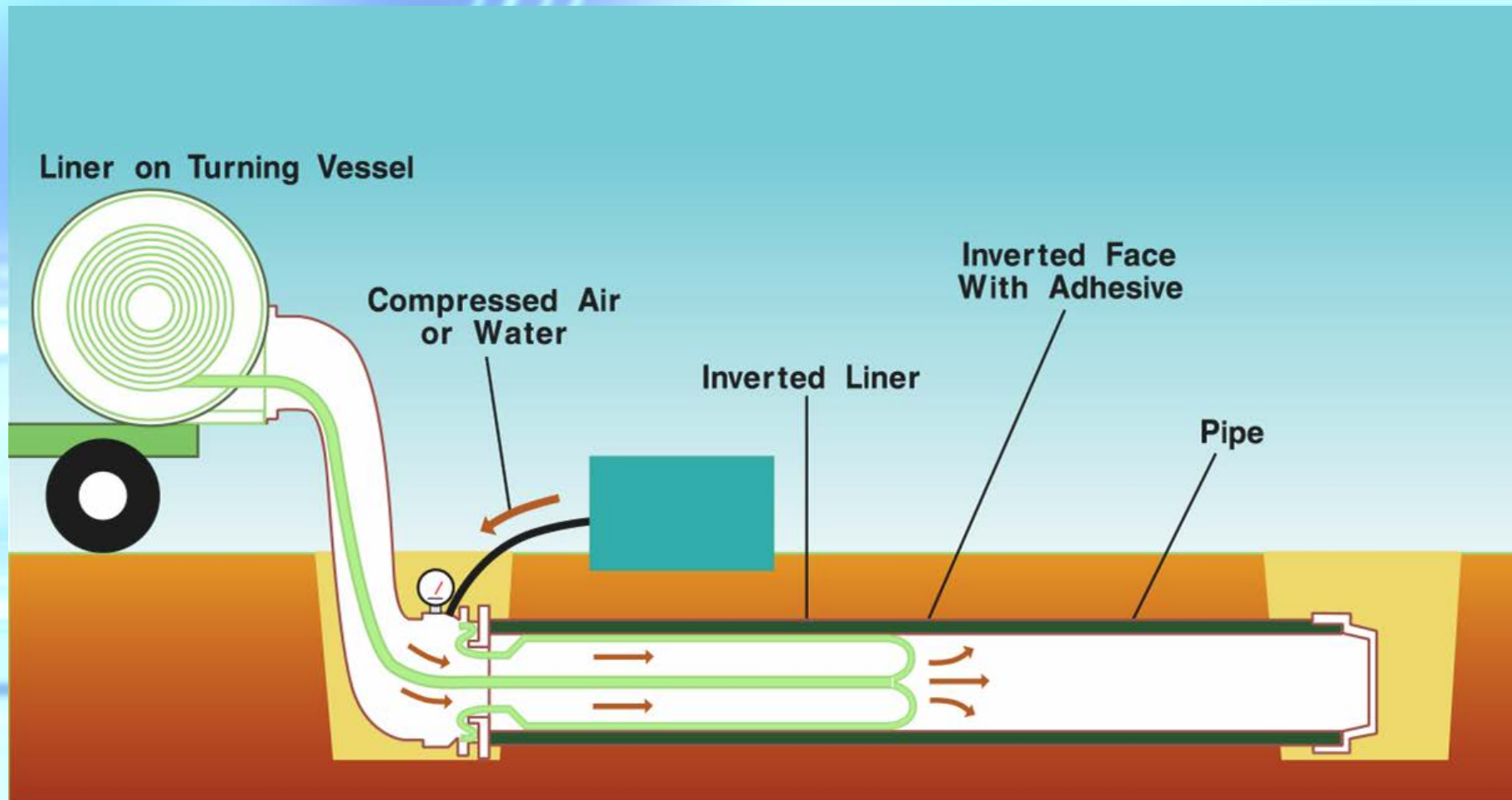
HISTORY CIPL

- **1991 – CIPL Germany application leaking CI**
 - 94% leak reduction
 - 2.8 million m³ methane emission reduction
- **1993 – GRI R&D program initiated**
 - Installation evaluation/demonstration
 - ✓ *Mains*
 - ✓ *Services*
 - Testing program
 - Material evaluation
 - Longevity
 - Service connections

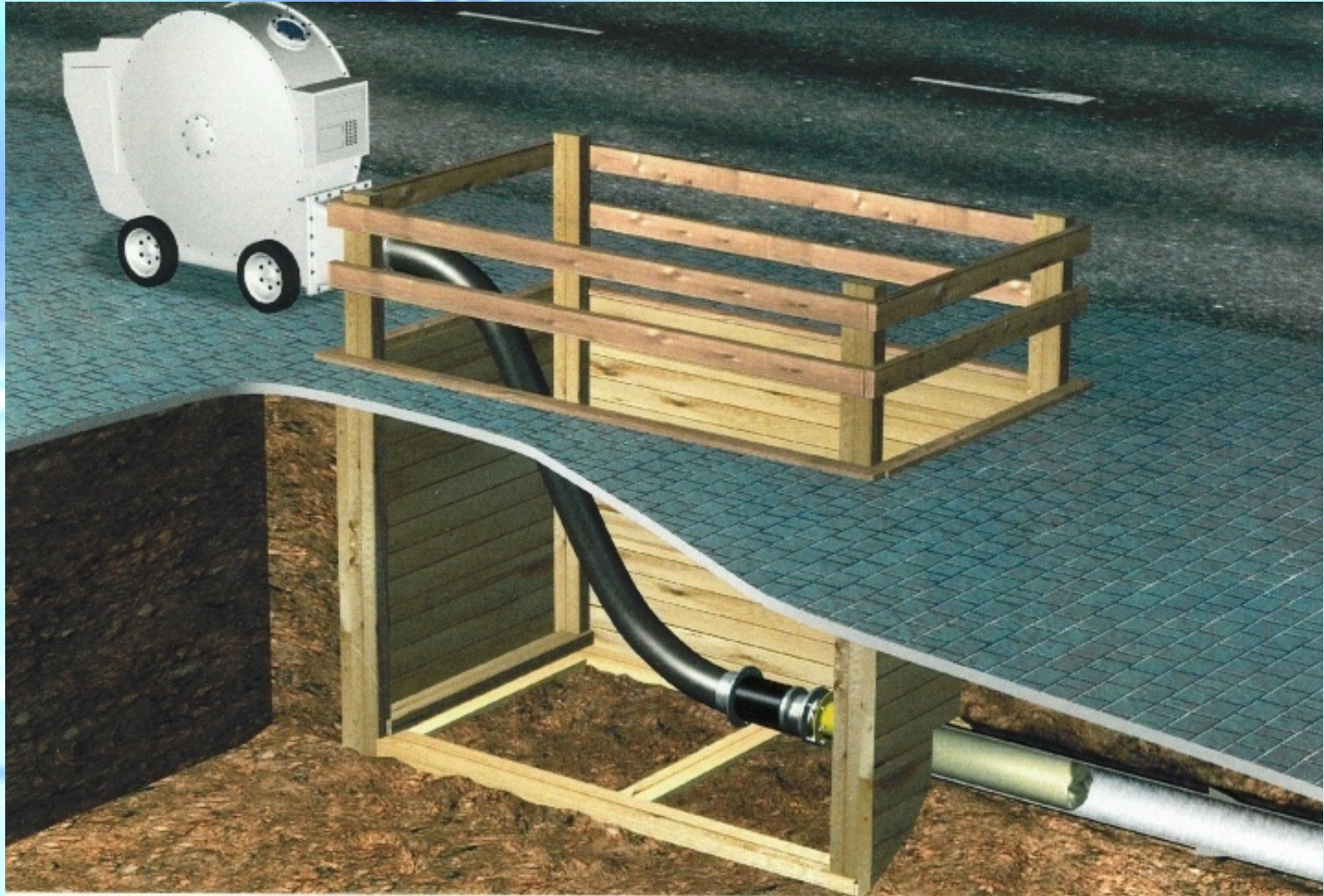
HISTORICAL SUMMARY

- **32 years operating experience**
 - Mains
 - Services
- **No failures**
- **Viable and proven renewal technique**
 - Significant
 - Substantial
- **Proven combination of strength and flexibility**

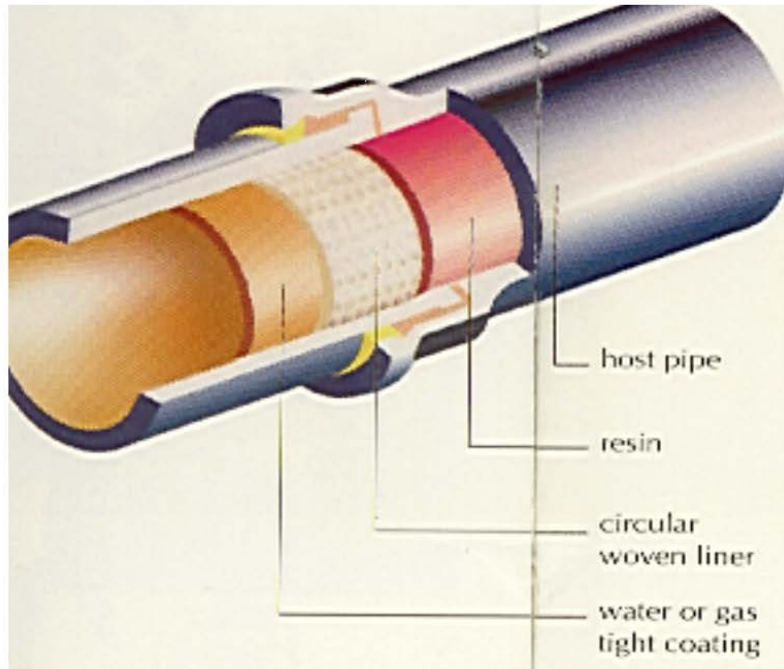
WHAT IS CIP LINING?



INVERSION EQUIPMENT IMAGE



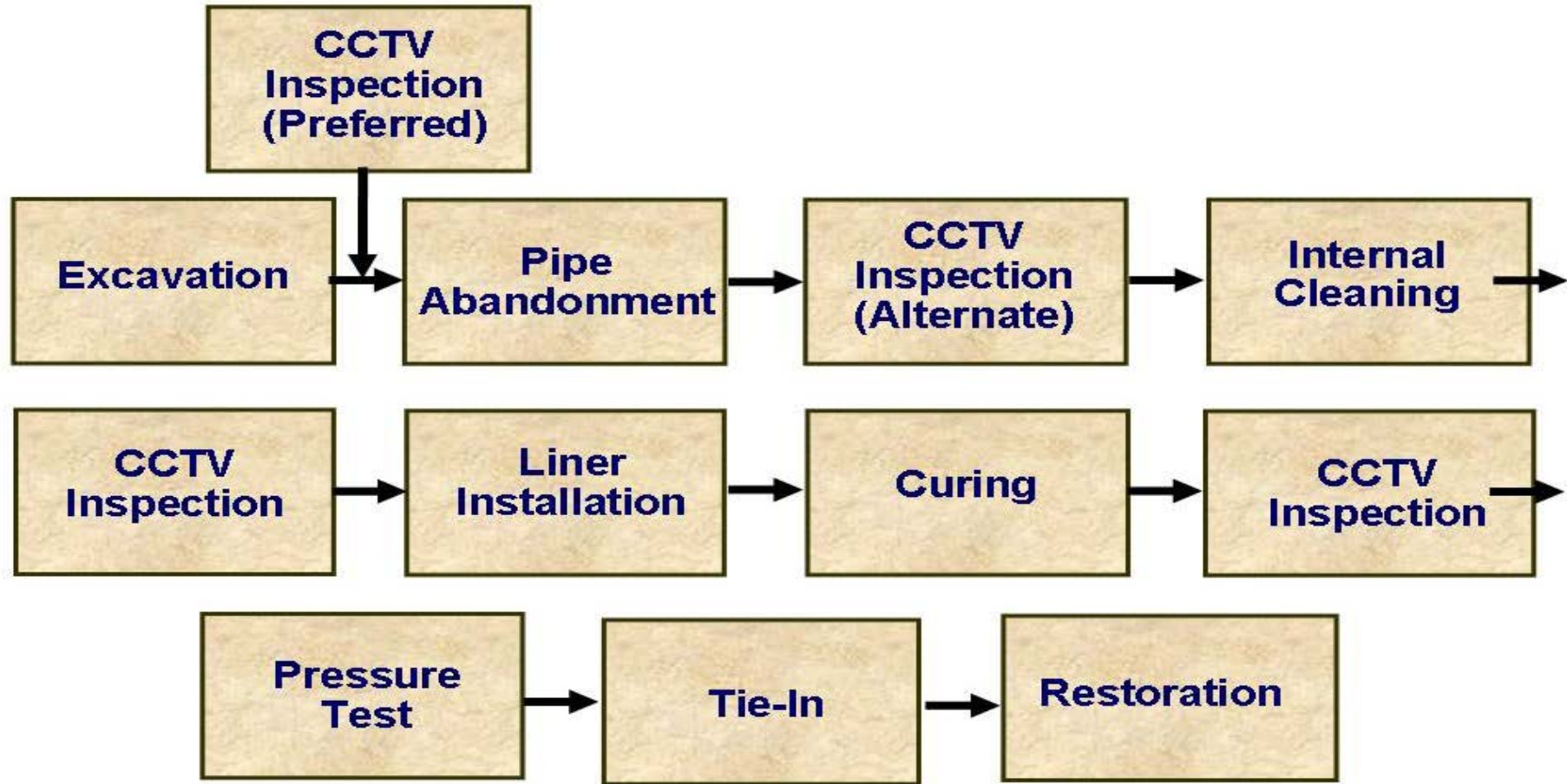
ANATOMY OF A CIP LINER



The starline® hose is a seamless circular woven fabric-hose made of polyester yarns and a plastic coating (PU or PE) which is bonded as inner liner into the host pipe using a solvent-free two-component adhesive

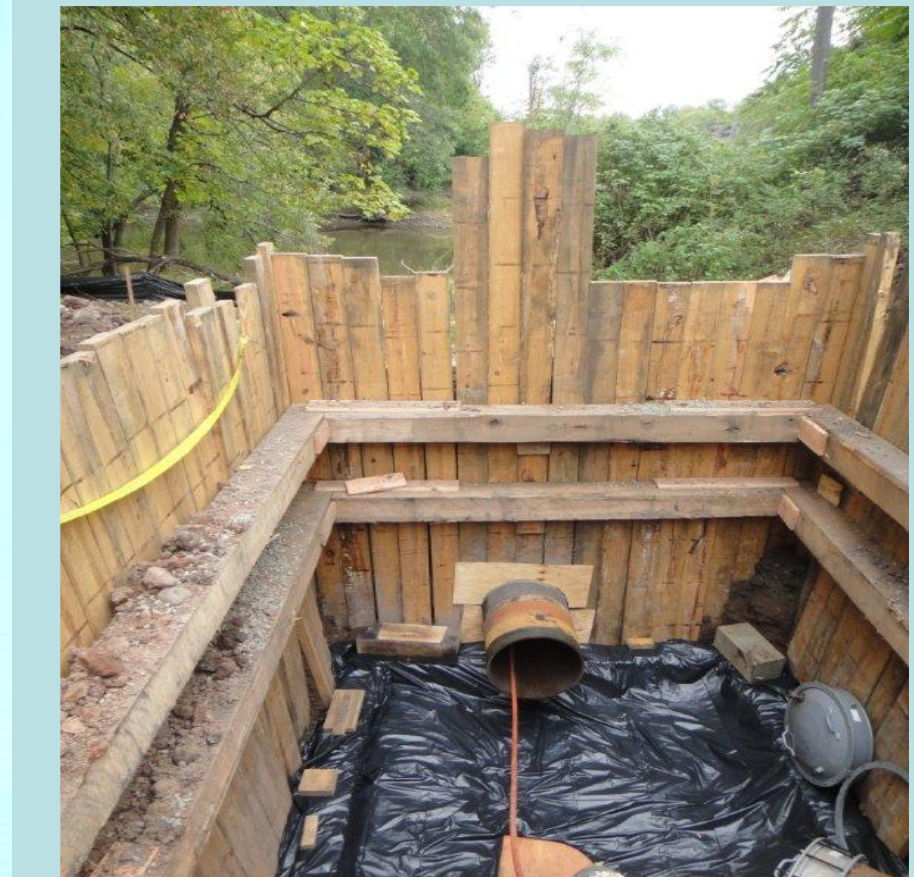
CIP Liners - Sizes $\frac{3}{4}$ " - 48", up to 300 psig, steel and CI pipe

PROCESS FLOW



CURRENT MAIN APPLICATIONS

- **Pumping Mains**
 - Large diameter
 - No services
 - Maintain flow capacity
 - Fittings/bends
- **Crossings**
 - Highway
 - Railroad
 - Aboveground
 - Heavy traffic/subsurface
 - Inaccessible





SOMETIMES A "NO-DIG" OPTION MAKES SENSE

PROGRESS TO DATE

- **Well established pedigree through extensive testing**
 - GRI
 - IGT
 - Battelle
 - University of Pennsylvania
 - Cornell
 - ASTM
- **R&D**
 - Increase capacity
 - Reduce customer outage time
- **Process efficiencies**

ASTM TESTING - 2002

- **Liner & Adhesive Manufacturing Testing Criteria per ASTM F2207-02 (100 psig)**
- **Collaboration between Karl Weiss, Starline, GTI and PPM**



ASTM TESTING

- **Tested ALL Aspects of the Process**
 - Liner Construction (Woven Jacket & Elastomer Skin)
 - Adhesive System (Post Install & Curing)
 - Composite Mechanical Properties (Liner & Adhesive Post Curing)

PSE&G Gas Main Projects Completed (Since 1992)

- **75 Projects**
- **40,000 Feet**
- **Steel/CI/WI**
- **3-30 Inches Diameter**
- **Up To 60 psig**



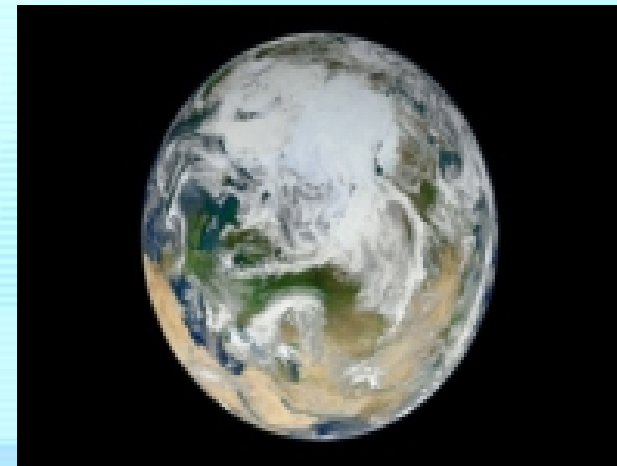
Over \$10 Million Savings

U.S. EXPERIENCE

- **No failures**
- **Well integrated into operations**
 - Cutting
 - Tapping
 - Stop-off
 - Repair
- **Enhanced safety**

BENEFITS

- **Improved flow**
- **Reduced pressure drop**
- **Minimum disruption**
- **\$10M savings (\$250/ft.)**
 - Excavation
 - Restoration
 - Traffic control
 - Inaccessible facilities
- **Reduced GHG**



Questions

