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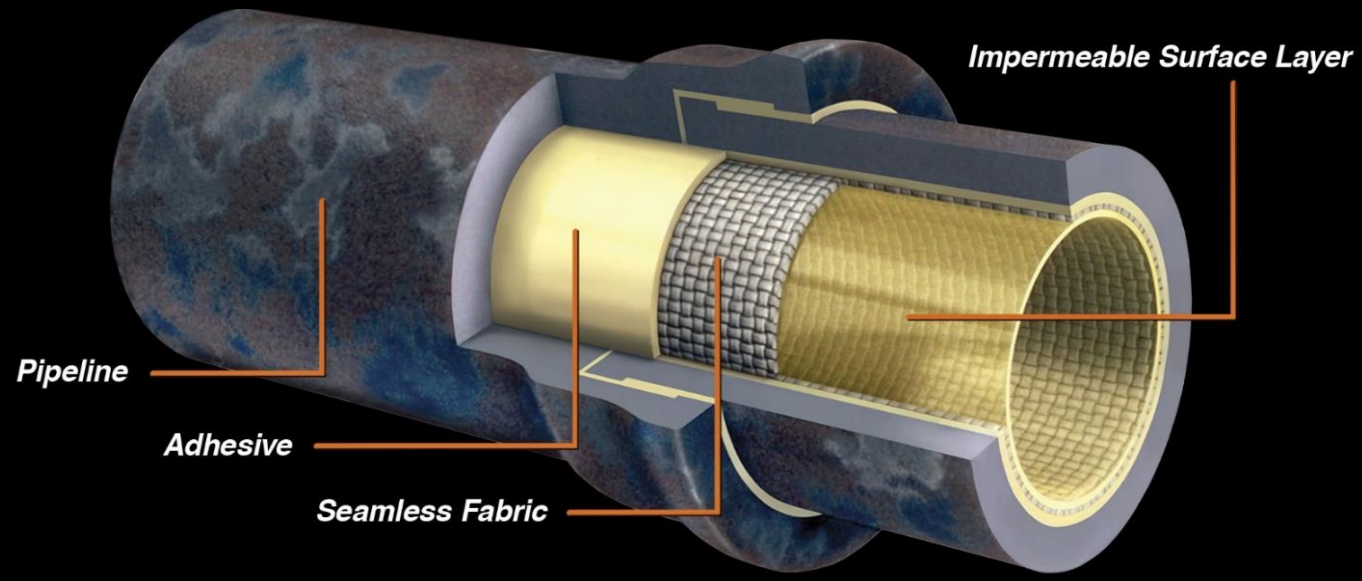
THE INFRASTRUCTURE RENEWAL SPECIALISTS

Cured-in-Place-Lining

As a Pipeline Rehabilitation Emissions Reduction Tool



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A Compelling Need for Trenchless

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The Starline® Cured-In-Place (CIPL) lining application is a trenchless technology designed to recondition and renew existing metallic gas and pressure pipelines.

- Elimination of Methane Gas Emissions
- Pipe sections of up to 1,000 feet in length
- Metallic Natural Gas & Pressure Pipelines - 4" through 48" in pipe diameter
- Can Negotiate Multiple Bends, Open Valves, Tap Holes & Laterals
- Has been tested to withstand 100 years of service.
- The service life of a Starline lined pipe is equal to that of a new pipe

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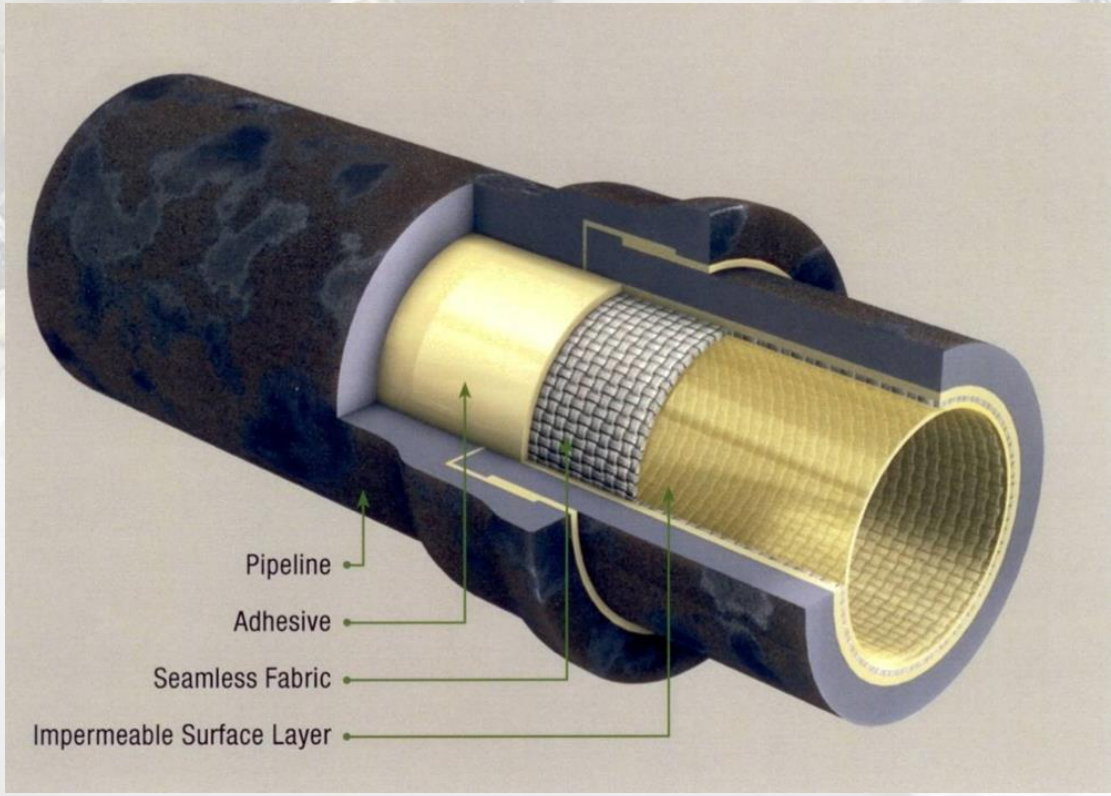
What is Starline CIPL

1. Seamless Circular Woven fabric made of Polyester Yarns
2. polyurethane Non- Permeable Inner Skin
3. Solvent Free 2-part Epoxy Adhesive
4. Host Pipe
5. Collectively a Composite Pipeline



CIPL vs. CIPP (Bonding is the Key!)

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Benefits of Starline CIPL

- Complete End-to-End Rehabilitation
- Adds 100+ Years of NEW Service Life
- Seals ALL Leaks & Prevents Future Leaks
- Minimizes Excavations, Traffic Congestion & Restoration
- Eliminates Internal Corrosion
- *Green* Technology That Eliminates Methane Emissions

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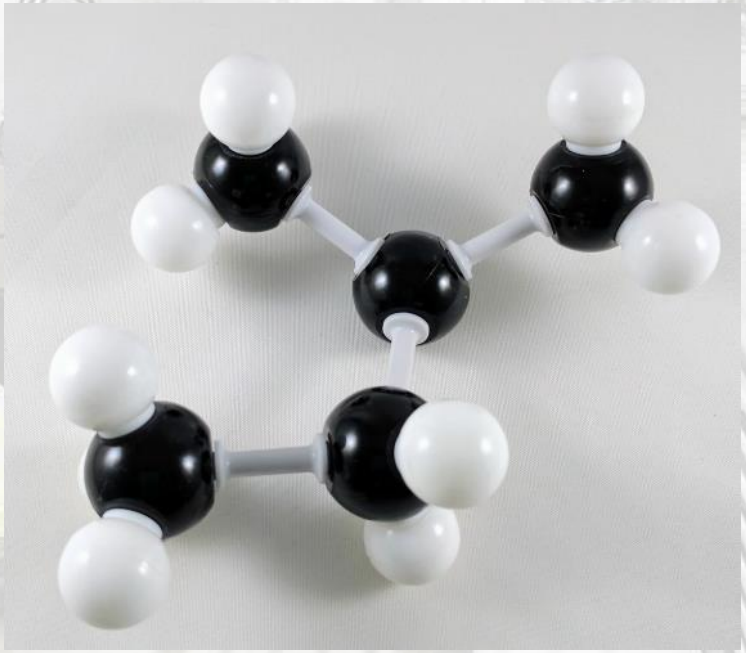
Reducing Emissions & Carbon Footprint

- CIPL allows gas operators to use advanced leak repair technology to permanently eliminate leaks and minimize methane emissions.
- Significantly lower carbon footprint compared to traditional “remove and replace” practices.
- CIPL minimizes the impact of excavations and reduces traffic congestion



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Reducing Emissions & Carbon Footprint

Carbon Emissions Study - CIPL vs. Replacement

Comparison of carbon emissions between CIPL technology and traditional trench and replace methods

- 4" – 12" Trench and Replace (Steel or Plastic)
- 16" – 24" Trench and Replace (Steel)
- 30" – 48" Trench and Replace (Steel)
- 4" – 48" Reconditioned Steel or Cast Iron (CIPL)

Assessment of:

- Scope of Work
- Required Equipment
- Equipment Emissions Value
- Duration of use

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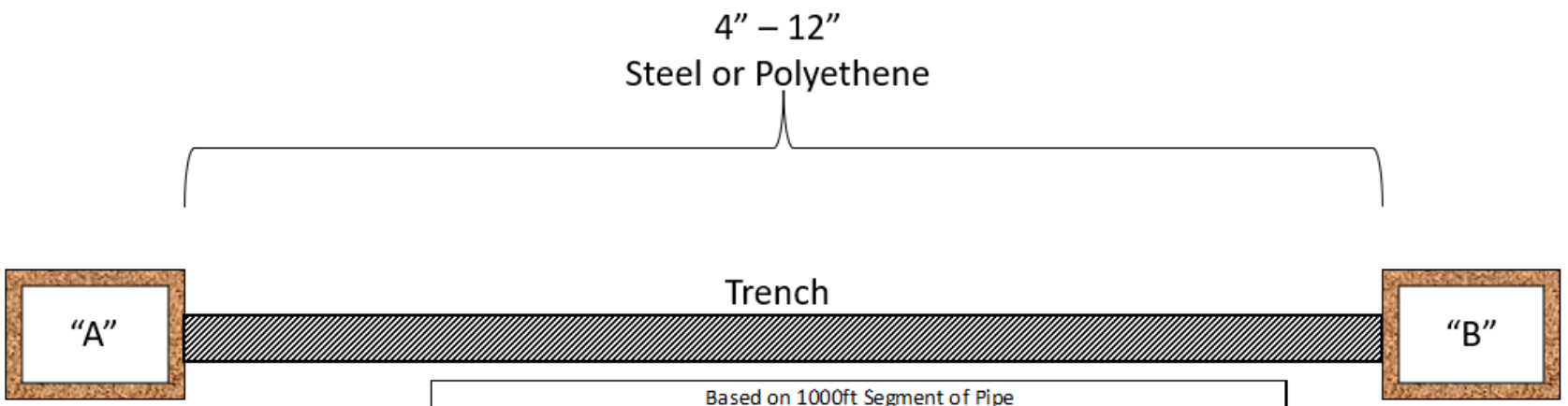
Reducing Emissions & Carbon Footprint



Pits "A" & "B" are Always
The Same size Regardless of
Steel, Polyethene
Or Reconditioning (Lining)

Based on 1000ft Segment of Pipe					
Equipment	Replacement Pipe - Steel or Polyethene 4" - 12"				
Saw-Cutting (Diesel)	Hours	24			
Backhoe (Diesel)	Hours	80			
Dump Truck (Diesel)	Hours	80			
Welding / Fusing Truck (Diesel)	Hours	80			
Pressure Drum (Diesel)	Hours	0			
Camera Truck (Diesel)	Hours	0			
Sandblast Truck (Diesel)	Hours	0			
Vacuum Truck (Diesel)	Hours	0			
Trenching / Backfilling / Paving	Length (ft)	Width (ft)	Depth (ft)	Each	Cubic/Yards
Excavation (Trench)	1000	2	5	1	370
Backfill (Trench)	1000	2	4	1	296
Excavation (Bell-Holes)	0	0	0	0	0
Backfill (Bell-Holes)	0	0	0	0	0
Asphalt Replacement	1000	2	1	1	74
Material	Length (ft)	Width (ft)	Depth (ft)		Square/Ft
Steel or Polyethene Pipe	1000				
Liner Material & Adhesive	0				
Bell-Hole Sheeting (Lumber)	0	0	0		0

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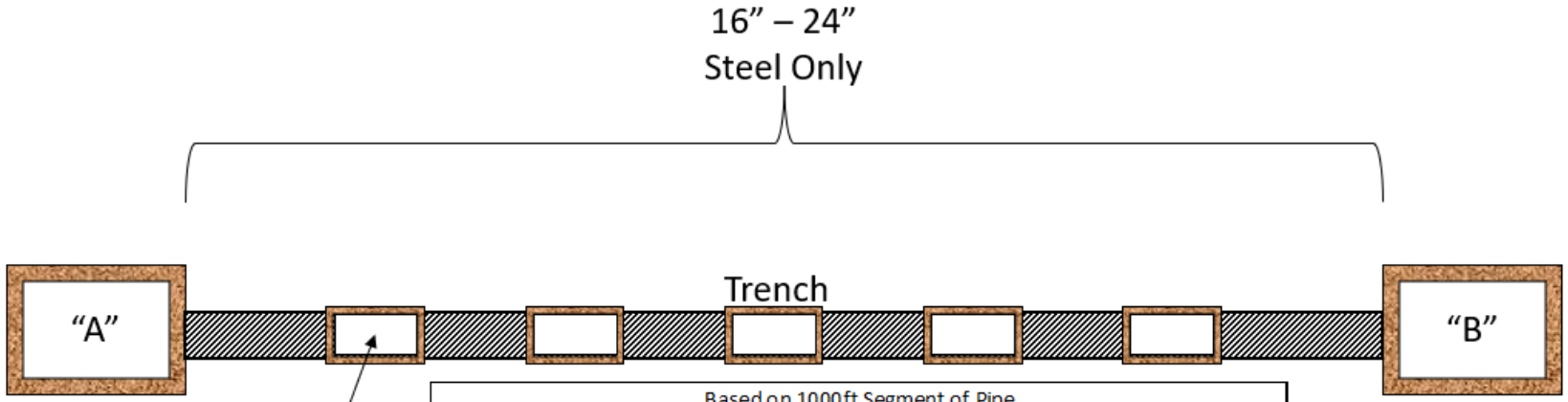
Reducing Emissions & Carbon Footprint



Pits "A" & "B" are Always
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Or Reconditioning (Lining)

Based on 1000ft Segment of Pipe

Equipment	Replacement Pipe - Steel 16" - 24"				
Saw-Cutting (Diesel)	Hours	24			
Backhoe (Diesel)	Hours	176			
Dump Truck (Diesel)	Hours	176			
Welding / Fusing Truck (Diesel)	Hours	176			
Pressure Drum (Diesel)	Hours	0			
Camera Truck (Diesel)	Hours	0			
Sandblast Truck (Diesel)	Hours	0			
Vacuum Truck (Diesel)	Hours	0			
Trenching / Backfilling / Paving	Length (ft)	Width (ft)	Depth (ft)	Each	Cubic/Yards
Excavation (Trench)	1000	3	6	1	667
Backfill (Trench)	1000	3	5	1	556
Excavation (Bell-Holes)	6	6	6	25	200
Backfill (Bell-Holes)	6	6	6	25	200
Asphalt Replacement	1000	3	1	1	111
Material	Length (ft)	Width (ft)	Depth (ft)		Square/Ft
Steel or Polyethene Pipe	1000				
Liner Material & Adhesive	0				
Bell-Hole Sheeting (Lumber)	6	6	6	25	5400

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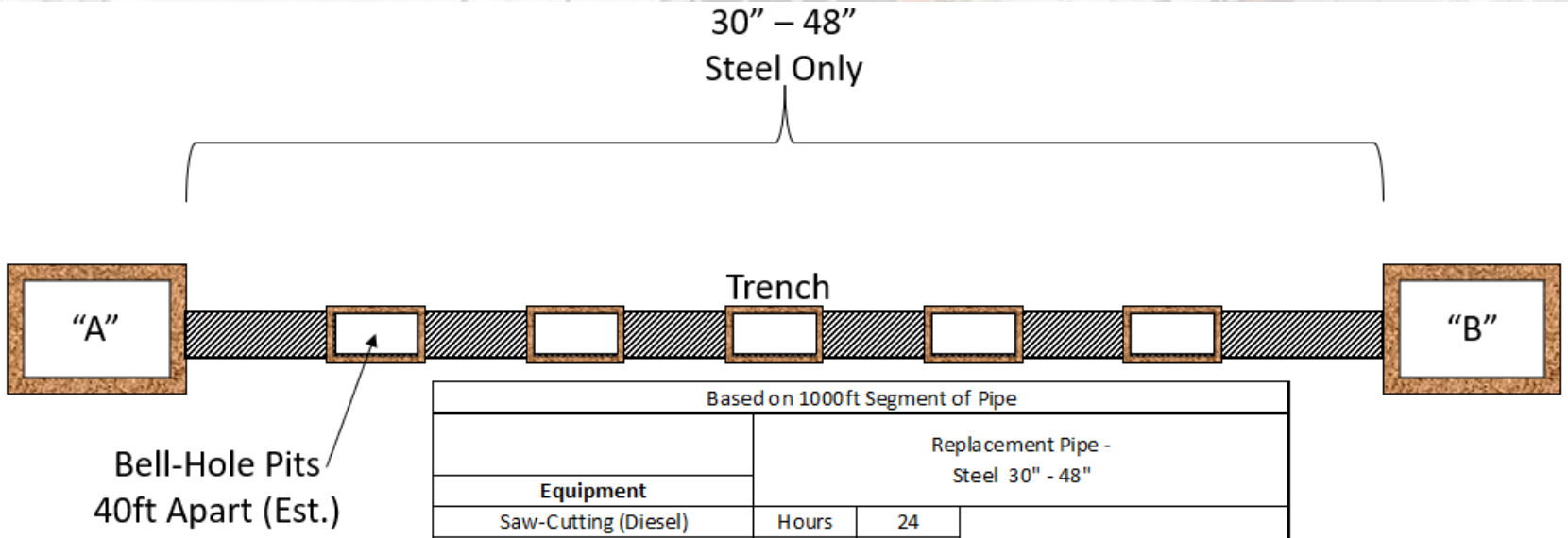
Reducing Emissions & Carbon Footprint



Pits "A" & "B" are Always
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Or Reconditioning (Lining)

Based on 1000ft Segment of Pipe

Equipment	Replacement Pipe - Steel 30" - 48"	
Saw-Cutting (Diesel)	Hours	24
Backhoe (Diesel)	Hours	344
Dump Truck (Diesel)	Hours	344
Welding / Fusing Truck (Diesel)	Hours	344
Pressure Drum (Diesel)	Hours	0
Camera Truck (Diesel)	Hours	0
Sandblast Truck (Diesel)	Hours	0
Vacuum Truck (Diesel)	Hours	0

Trenching / Backfilling / Paving	Length (ft)	Width (ft)	Depth (ft)	Each	Cubic/Yards
Excavation (Trench)	1000	8	8	1	2370
Backfill (Trench)	1000	8	7	1	2074
Excavation (Bell-Holes)	8	8	8	25	474
Backfill (Bell-Holes)	8	8	8	25	474
Asphalt Replacement	1000	8	1	1	296

Material	Length (ft)	Width (ft)	Depth (ft)		Square/Ft
Steel or Polyethene Pipe	1000				
Liner Material & Adhesive	0				
Bell-Hole Sheeting (Lumber)	8	8	8	25	12800

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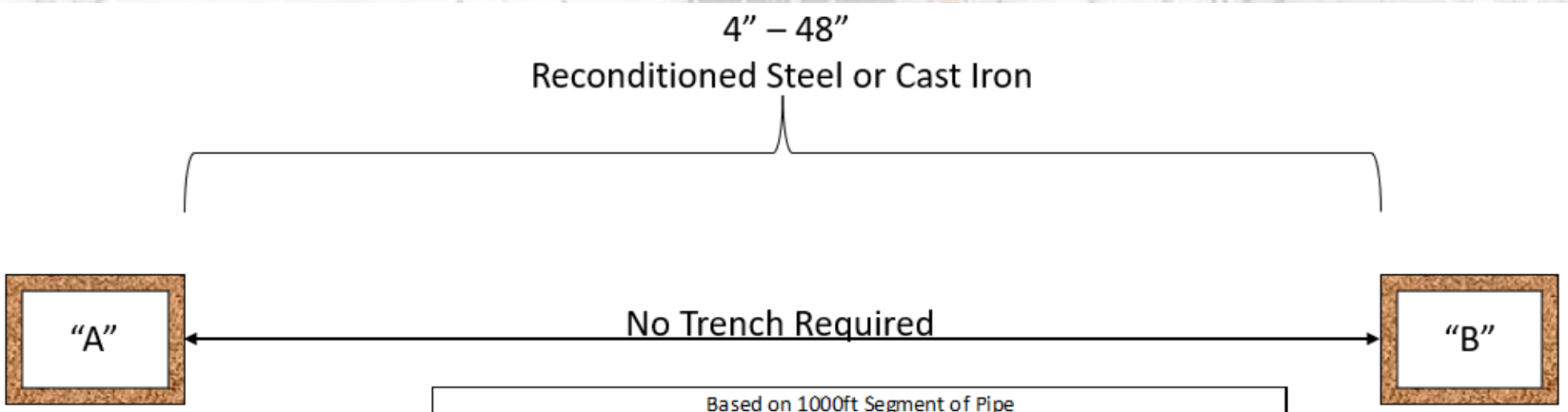
Reducing Emissions & Carbon Footprint



Pits "A" & "B" are Always
The Same size Regardless of
Steel, Polyethene
Or Reconditioning (Lining)

Based on 1000ft Segment of Pipe					
Equipment	Reconditioned (Lined) Pipe - Steel or Cast Iron 4" - 48"				
Saw-Cutting (Diesel)	Hours	0			
Backhoe (Diesel)	Hours	0			
Dump Truck (Diesel)	Hours	0			
Welding / Fusing Truck (Diesel)	Hours	0			
Pressure Drum (Diesel)	Hours	8			
Camera Truck (Diesel)	Hours	16			
Sandblast Truck (Diesel)	Hours	16			
Vacuum Truck (Diesel)	Hours	16			
Trenching / Backfilling / Paving	Length (ft)	Width (ft)	Depth (ft)	Each	Cubic/Yards
Excavation (Trench)	0	0	0	0	0
Backfill (Trench)	0	0	0	0	0
Excavation (Bell-Holes)	0	0	0	0	0
Backfill (Bell-Holes)	0	0	0	0	0
Asphalt Replacement	0	0	0	0	0
Material	Length (ft)	Width (ft)	Depth (ft)		Square/Ft
Steel or Polyethene Pipe	0				
Liner Material & Adhesive	1000				
Bell-Hole Sheeting (Lumber)	0	0	0		0

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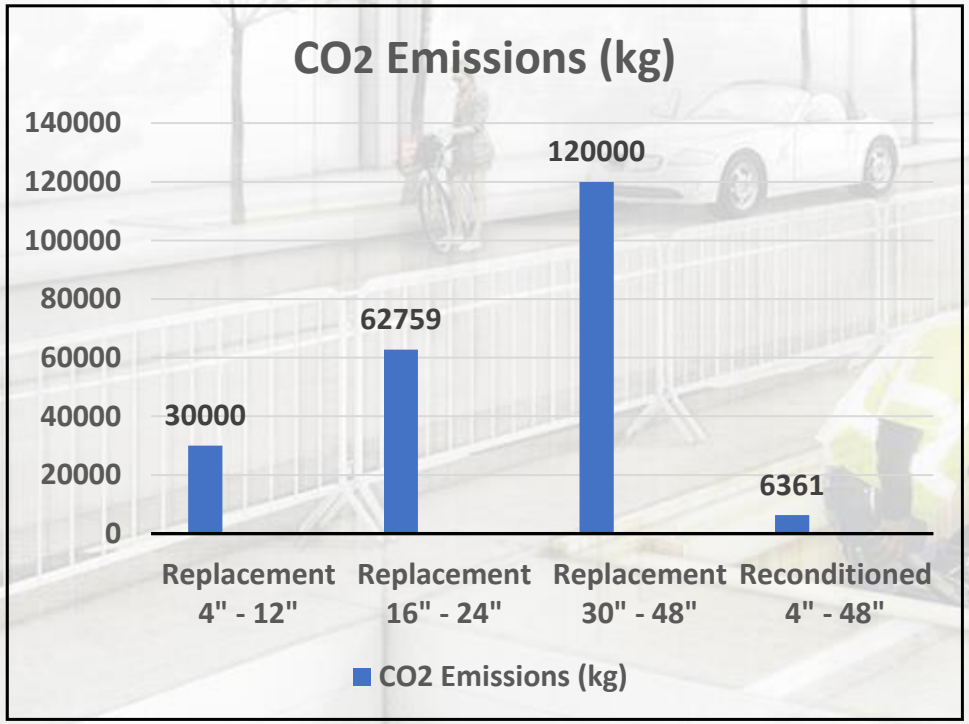
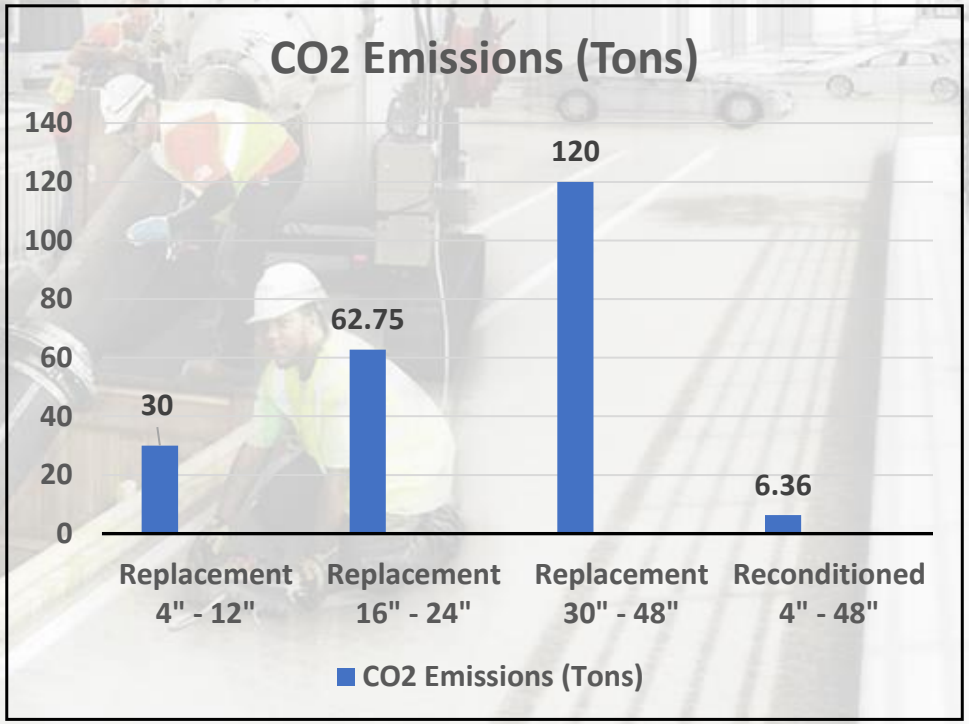
Reducing Emissions & Carbon Footprint





4" – 12" Replacement vs CIPL

CIPL = **6.36 Tons CO_2**
Replacement = **30 Tons CO_2**

✓CIPL **4.7x Cleaner**

16" – 24" Replacement vs CIPL

CIPL = **6.36 Tons CO_2**
Replacement = **62.75 Tons CO_2**

✓CIPL **9.9x Cleaner**

30" – 48" Replacement vs CIPL

CIPL = **6.36 Tons CO_2**
Replacement = **120 Tons CO_2**

✓CIPL **18.9x Cleaner**

On Average, CIPL is over 11x Cleaner than Trench and Replace Methods

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Lining Process

CCTV

PRE-CLEAN INSPECTION

- Determine amount of surface prep needed on interior of pipe segment.
- Confirm there are no unmarked obstacles or anomalies.
- Identification of service taps

POST-CLEAN INSPECTION

- Determine if cleaning operation passes inspection, and if additional cleaning is required
- Wheeled crawler with pan and tilt camera gives operator full 360° image.
- CCTV records video of all finds, and measurements are logged in a field report to be presented to client.

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Lining Process

SURFACE PREPERATION "CLEANING"

- Proprietary "Abrasive Blast" cleaning process
- Simultaneous vacuum recovery of cleaning waste
- Abrasive Blast cleaning removes dry PCB's from pipeline
  - Liquid contamination to be eliminated through Pipe Jetting
- Post-cleaning CCTV Inspection

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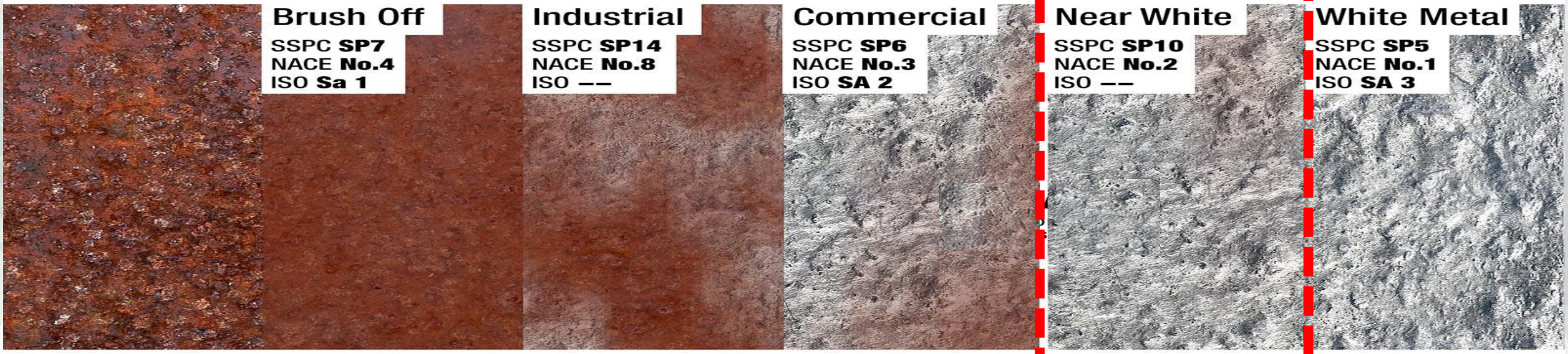
Lining Process

Surface Preparation "Cleaning"

NACE INTERNATIONAL

NACE Industry Standard

"National Association of Corrosion Engineers"



Loose Material	None	None	None	None	None
Tight Material	100%	up to 10%	None	None	None
Stains, Shadows	100%	100%	up to 33%	up to 5%	None

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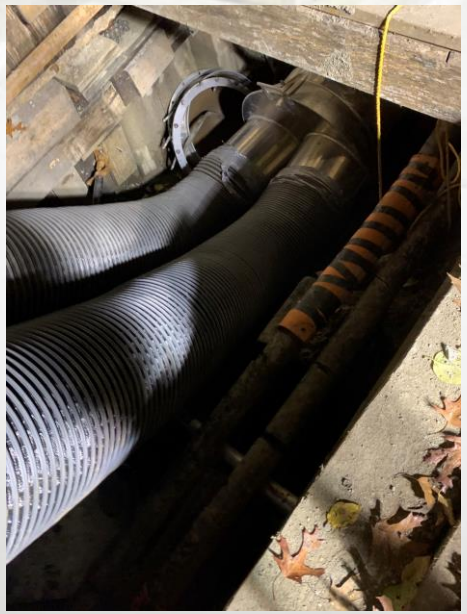
Lining Process

VACUUM COLLECTING

- Used to capture all debris within pipe while sandblasting
- 20,000 CFM, Air velocity greater than 45mph
- Anemometer measures velocity at mouth of pipe
- Smaller Footprint, Very Quiet, Easy Assembly



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Cleaning Process Animation

Lining Process

LINER "WET-OUT"

- Hand-mix 2 component Epoxy adhesive (Non-Haz)
- PPM's adhesive is not "glue."
  - epoxy that is moldable
  - fills any surface irregularities, gaps, holes, cracks or fissures.
- Add adhesive to liner
  (rollers ensure 100% saturation)
- Load liner into pressure drum

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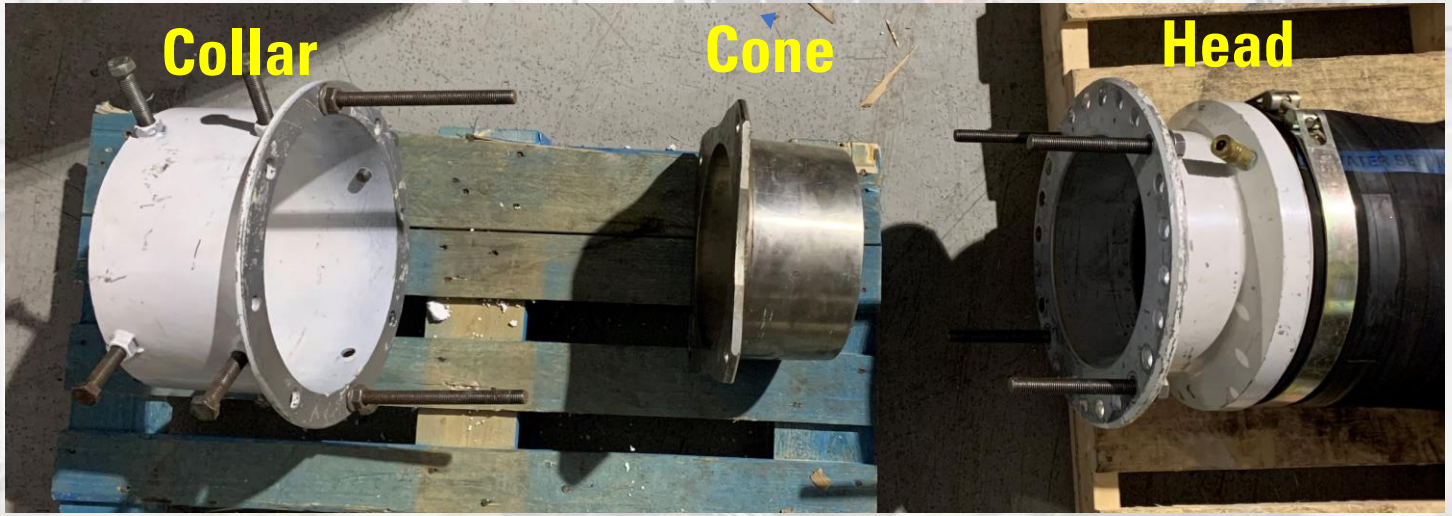
Lining Process



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Lining Process

LINER INVERSION

- "Invert" liner into cleaned pipe with air pressure
- compressed air inverts the liner "inside-out" into the host pipe where the adhesive impregnated fibers come into direct contact with the cleaned surfaces of the main.
- Begin curing process

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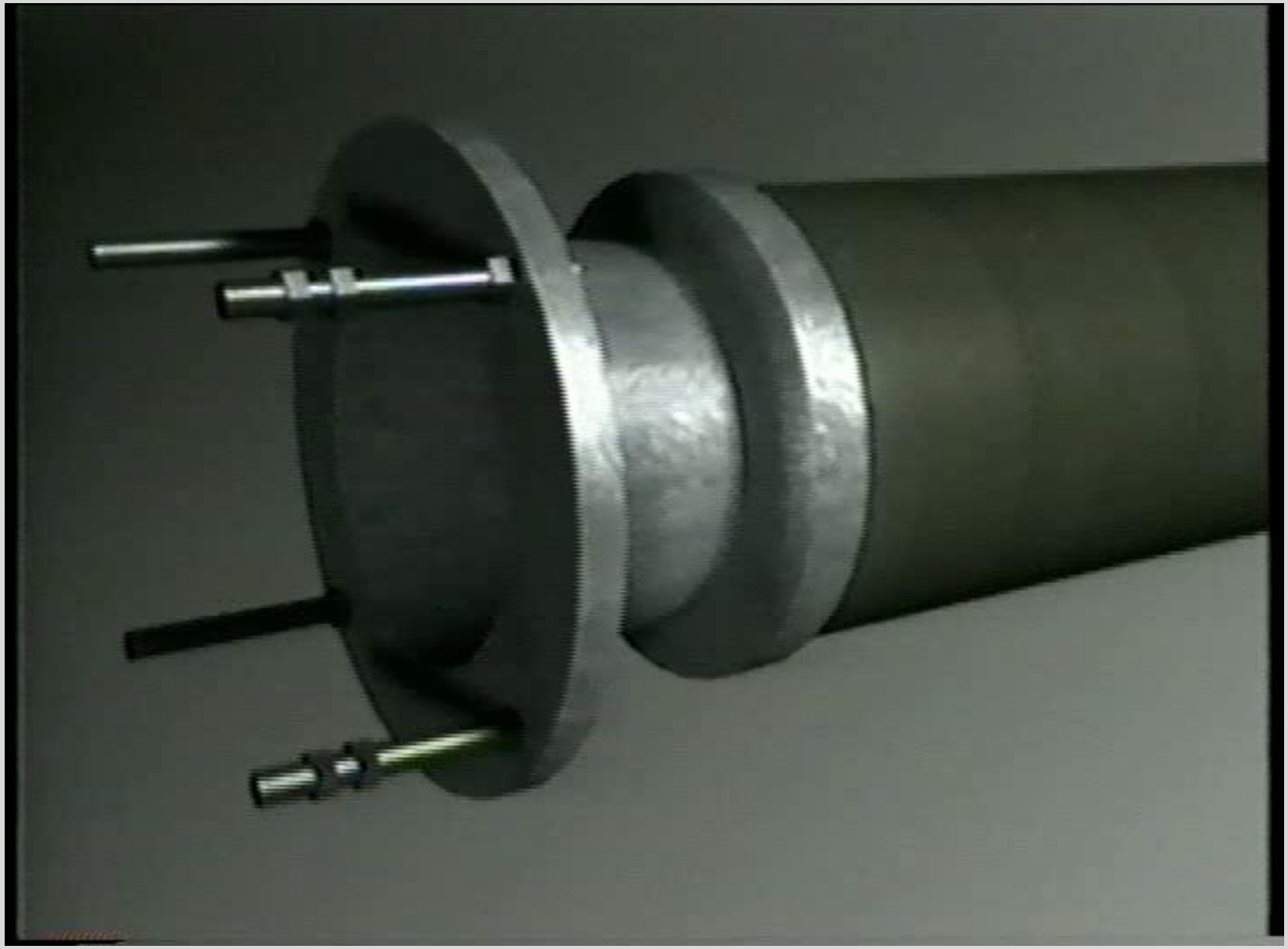
Lining Process Animation



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Lining Process

LINER CURING

- The adhesive requires approximately 16 to 24 hours to fully cure in normal temperature ranges.
- A calibrated data recorder is used, to ensure consistency and monitor the internal pressure of the lined pipe.
- Nitrogen cannisters are attached to main to replace any drop in original pressure caused by ambient temperature.
- A hardness meter or Durometer is used to ensure liner is cured. A fully cured liner will have a hardness of 48 or above.

Robotic Service Reinstatement

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Lining process

POST-LINE INSPECTION

- After Liner has cured, main is depressurized and all hardware is removed.
- Ends of liner are trimmed flush.
- CCTV Inspection is performed.

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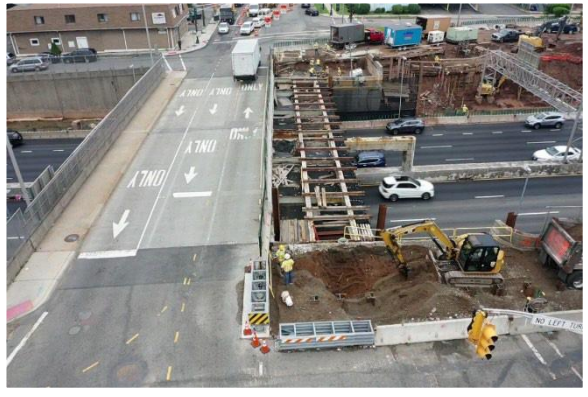
Site Selection

- Crossings (Bridges, Railroads, Rivers, Highways, Intersections)
- Large Diameter Pipe Where Throughput Cannot be Reduced
- Urban Centers & Areas of High Concern (Schools, Churches, Hospitals)
- High Cost Restoration areas (Curb to Curb Paving, Stringent & Costly Stips)
- Leak Prone Or Areas Where Methane Emissions are detected



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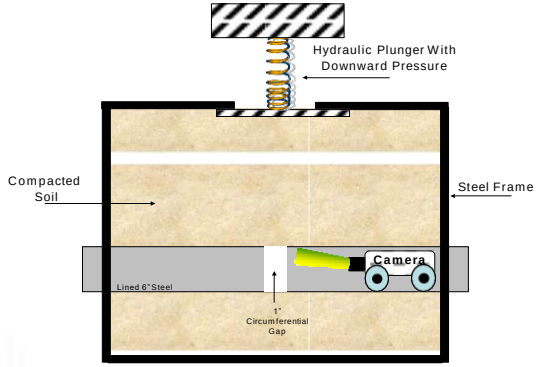
STARLINE CIPL TESTING

- Over $15 Million Invested in Testing Longevity & Performance
- 2002 ASTM Testing for F2207-02 and 2006 for F2207-06
- 2004: NYS Cast Iron Undermine Testing
- 2010: Worse Case Corrosion Testing for Bare Steel Pipelines
- 2017: DOT / PHMSA Longevity Testing at Cornell – “100 Year Test”



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Starline Experience

1,550,000 Feet RENEWED with Starline CIPL

- 2021 - 36" Cast Iron aka "The Mess" (NASTT Project of the Year Winner)
- 2019 - 600' of 42" Cast Iron with 6 Offsets – Largest Diameter Ever
- 2018 - 1,500' of 36" Cast Iron (NASTT Project of the Year Winner)
- 2011 - Structural Reinforcement Sleeve (NASTT Project of the Year Winner)
- 2006 - 16" Citizens Tunnel (NASTT Project of the Year Runner Up)

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Questions

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