

Composite Wrap

Lessons Learned
from Natural Gas STAR



EPA's Natural Gas STAR Program,
Pioneer Natural Resources USA, Inc., and
The Gas Processors Association

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Composite Wrap



Permanent On-Line
Pipeline Repair
Technology

Source: Armor Plate



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- Methane Losses
- Technology Description
- Methane Recovery
- Is Recovery Profitable?
- Industry Experience
- Discussion Questions



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- Use of 30 wrap repairs versus line replacements could save 70,000 Mcf/yr netting almost \$130,000 in savings
- Repairs with pipeline in service average 2 days versus 5-7 days for typical cut & weld pipe replacements

**A QUICK & SAFE WAY
to improve profitability &
AVOID VENTING
METHANE!**



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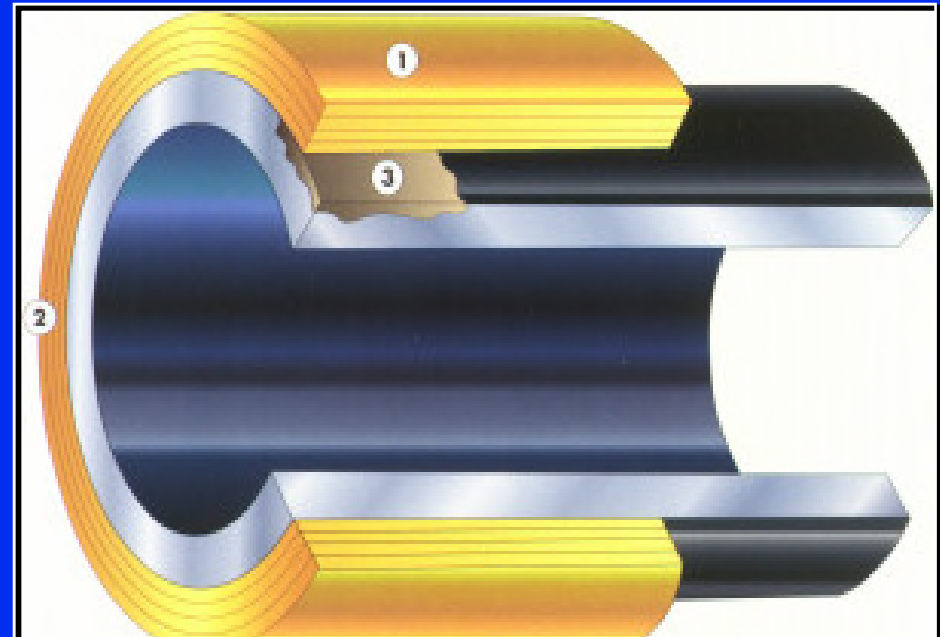
□ **Before January 13th, 2000** repair methods were restricted to replacement, or use of full encirclement steel sleeves welded in place

□ **And now** the steel sleeve requirement is amended to allow composite wrap sleeves



Composite Wrap What Are They?

1. A high strength glass fiber composite or laminate
2. An adhesive or resin bonding system
3. A high-compressive-strength load transfer filler compound



Source: Clock Spring® Company L. P.



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Composite Wrap When to Use

- ❑ Pipeline defects must be carefully analyzed
- ❑ Follow industry standards: ASME B31G or RSTRENG (modified B31G)
- ❑ Composite wrap vendors typically supply defect analysis and repair reporting software
- ❑ Permanent repair for external, non-leaking defects



Source: Armor
Plate



Composite Wrap Software

- Software will determine:
 - ◆ if a repair is needed
 - ◆ if a composite wrap is suitable
 - ◆ or if a pipe replacement is required

- Defects up to 80% loss wall thickness can be repaired with composite wrap

- There may be pressure and temperature restrictions on composite wrap



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Composite Wrap Installation History

- ❑ Tested extensively
- ❑ Used commercially since 2000
- ❑ Many partner reported experiences
- ❑ In USA: 15 wraps butted side-by-side have been used to repair lines 16-30" in diameter and 800-900 psi
- ❑ In Guatemala: 37 side-by-side composite wrap sleeves have been used
- ❑ In USA: 22,000 sq. ft. applied in 9 days



Composite Wrap Installation

- After excavation and pipe preparation
 - ◆ External defects are filled with filler
 - ◆ Composite wrap wound around pipe with adhesive or laminating agents
 - ◆ Typically 2" of wrap must extend beyond damage
 - ◆ After mandated drying or curing time, excavation site refilled
- While lines can be repaired at full pressure, reducing pressure improves quality of repair



Source: Armor Plate



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Economics & Environmental Benefits

- Quicker and less expensive
- Continuous pipeline operation
- No methane vented
- Trained personnel required versus skilled labor
- Install at full line pressure (reduced pressure is recommended)
- Installation takes about 30 minutes; curing about 2 hours
- Site access & preparation issues minimized



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Composite Wrap Decision Process

1. Determine suitability of composite wrap technique for repair option
2. Calculate cost for composite wrap and consider other benefits of on-line repair
3. Estimate methane savings
4. Calculate avoided costs of line replacement
5. Evaluate economics



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Step1: Determine Suitable Application

- ❑ Evaluate nature of defect and causal factors
- ❑ Evaluate operational needs and job site factors
- ❑ Follow industry standards, such as ASME, and your company engineering policies and procedures



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Step 2: Cost of Wrap Repair

GIVEN: 6" non-leaking defect in 24" line @ 350 psi

Estimate: 16 hours to repair

Cost of labor: Field Labor: 3 @\$30/hr = \$1,440
Eng Mgmt: 25% of \$1,440 = \$ 360

Cost of Equipment: Wrap Kit = \$ 900
Backhoe & Sandblaster = \$ 750

Other: Permits/Inspection/Misc = \$1,650



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Step 3: Estimate Methane Savings

Methane Savings = Emissions avoided from line replacement

$$\begin{aligned}\text{Volume of methane(Mcf)} &= (D^2 * P * (L/1,000) * 0.372) / 1,000 \\ &= 24 * 24 * 350 (52,800 / 1,000) * 0.372 / 1,000 \\ &= 3,960 \text{ Mcf @ } \$3/\text{Mcf} \\ &= \$11,900\end{aligned}$$

Note: for 10 miles between block valves



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Step 4: Calculate Purge Gas Savings

Purge Gas saved = Purge Gas used during line replacement

$$\begin{aligned}\text{Volume of Purge Gas} &= [3.14 * D^2 * L / (4 * 144 * 1,000)] * 1.2 \\ &= [3.14 * 24 * 24 * 52,800 / (4 * 144 * 1,000)] * 1.2 \\ &= 200 \text{ Mcf @ } \$4/\text{Mcf of nitrogen} \\ &= \$800\end{aligned}$$

Note: for 10 miles between block valves, assuming 20% wastage



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Step 4(cont'd): Replacement Line Cost

Given: 6" non-leaking defect in 24" line @ 350psi

Assume: replace 6' of line (3 times pipe diameter)

Estimate: 40 hours to repair

Cost of labor: Field labor: 4 @ \$30/hr	= \$4,800
Eng Mgmt: 25% of \$4,800	= \$1,200

Cost of Equipment: 6' pipe @ \$50/ft	= \$ 300
Backhoe, Welder & Crane	= \$3,700

Other: Permits/Inspection/Misc	= \$4,500
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Step 5: Evaluate the Economics

24" Line @ 350 psi		
6" Defect		
10 miles between shut off valves		
	Composite Wrap - \$	Line Replacement - \$
Methane Savings	11,900	none
Purge Gas	0	800
Labor	1,800	6,000
Equipment & Materials	1,650	4,000
Other	1,650	4,500
Total Cost of Repairs	5,100	15,300
Pay Back	IMMEDIATE!!	

INTANGIBLES:

- Safety
- Environmental impacts
- Site access
- Service interruption



Composite Wrap Partner Experience

- ❑ 300+ wraps on 10" or greater lines since 1995
- ❑ Limits repairs to 4 butted wraps, then replaces
- ❑ 20" defect in line near creek bed: limited environmental exposure, wrapped in 2 hours; total repair 2 days start to finish



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Composite Wrap Partner Experience

□ Primary considerations

- ◆ Can repair be done safely?
- ◆ Can repair be done in service?
- ◆ Can repair be done quickly?

□ Secondary considerations (but still important)

- ◆ Cost effective
- ◆ Methane emissions savings



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Lessons Learned

- ❑ Proven permanent repair for external defects
- ❑ Temporary repair for internal faults
- ❑ In-service pipeline repair methodology
- ❑ Ideal for urgent and quick repair
- ❑ Avoid service disruptions
- ❑ Cost effective versus alternatives
- ❑ Trained but not skilled crafts persons required
- ❑ Specialized welding and lifting equipment not required
- ❑ Minimizes access concerns
- ❑ No delays awaiting metal sleeve
- ❑ Cathodic protection remains functional



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Composite Wrap Lessons Learned

- METHANE EMISSIONS REDUCTIONS save you money and reduce greenhouse gas emissions



Composite Wrap Contacts

- www.epa.gov/gasstar/
- EPA Natural Gas Star Managers
- Vendors of composite wrap kits
 - ◆ Armor Plate, Inc.
 - <http://www.armorplateonline.com>
 - ◆ The Clock Spring® Company L.P.
 - <http://www.clockspring.com>
 - ◆ The StrongBack Corporation
 - <http://www.strongbackcorp.com>
 - ◆ WrapMaster, Inc.
 - <http://www.wrapm.com>



Composite Wrap Discussion Questions

- ❑ Has anyone used composite wrap repairs?
- ❑ What are the barriers(technological, lack of information, regulatory, and etc.) that are preventing you from implementing this technology?
- ❑ Would anyone like to elaborate on the information provided in this presentation?

