

# **Composite Wrap**

## **Lessons Learned**

### **from Natural Gas STAR**



**Murphy Exploration & Production,  
Gulf Coast Environmental Affairs Group,  
American Petroleum Institute and  
EPA's Natural Gas STAR Program**

**June 19, 2003**

# Composite Wrap

---



Source: Armor Plate

Permanent On-Line  
Pipeline Repair  
Technology



***Reducing Emissions, Increasing Efficiency, Maximizing Profits***

Page 2

# Composite Wrap

---

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



# Composite Wrap

---

- ❑ 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!**



# Composite Wrap

---

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

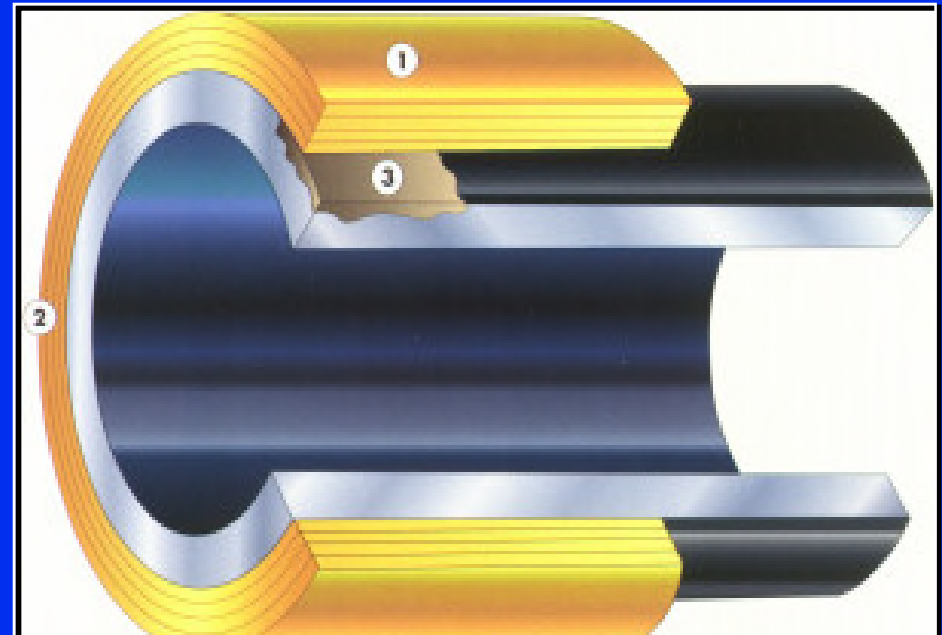
□ **And now** the steel sleeve requirement is amended to allow composite wrap sleeves



# 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.



*Reducing Emissions, Increasing Efficiency, Maximizing Profits*

# 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



# 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



# Composite Wrap

## 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



# 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



# Composite Wrap

## **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



EPA POLLUTION PREVENTER

*Reducing Emissions, Increasing Efficiency, Maximizing Profits*

# Composite Wrap

## 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



# Composite Wrap

## 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



***Reducing Emissions, Increasing Efficiency, Maximizing Profits***

# Composite Wrap

## 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



***Reducing Emissions, Increasing Efficiency, Maximizing Profits***

# Composite Wrap

## **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



# Composite Wrap

## 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



# 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



# Composite Wrap

## 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



EPA POLLUTION PREVENTER

*Reducing Emissions, Increasing Efficiency, Maximizing Profits*

# Composite Wrap Lessons Learned

---

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



*Reducing Emissions, Increasing Efficiency, Maximizing Profits*

# Composite Wrap Contacts

---

- [www.epa.gov/gasstar/](http://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?

