

# Composite Wrap for Non-leaking Pipeline Defects

Lessons Learned  
from Natural Gas STAR



Transmission Technology Transfer Workshop

Duke Energy Gas Transmission,  
Interstate Natural Gas Association of America (INGAA) and  
EPA's Natural Gas STAR Program

September 22, 2004

# Composite Wrap

---



Source: Armor Plate

**Permanent On-Line  
Pipeline Repair  
Technology**



EPA POLLUTION PREVENTER

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

# Composite Wrap

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

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



# Composite Wrap

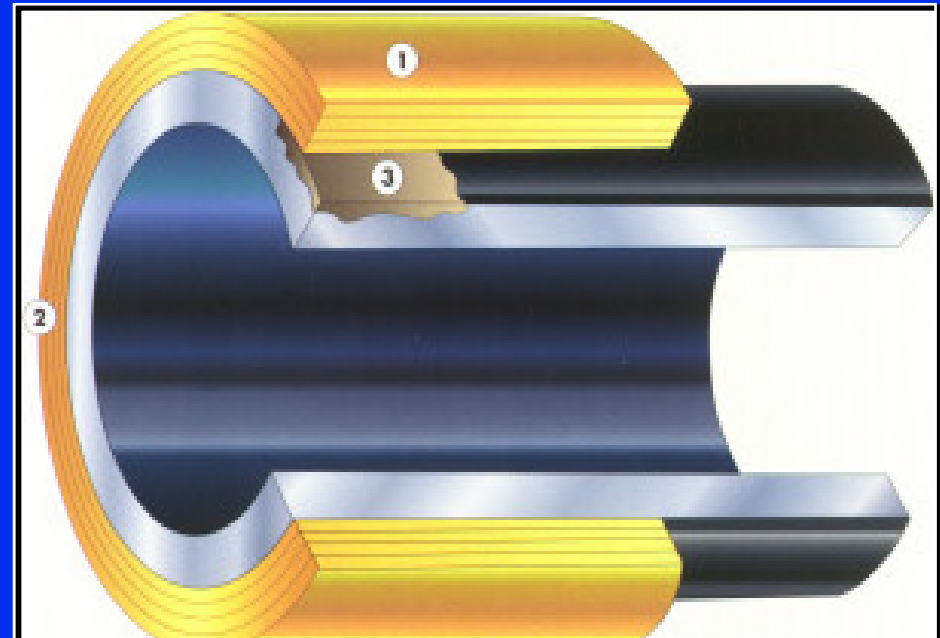
---

- **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.



# 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



EPA POLLUTION PREVENTER

*Reducing Emissions, Increasing Efficiency, Maximizing Profits*

# Composite Wrap Installation

- After excavation and pipe preparation
  - ◆ External defects filled with filler
  - ◆ Composite wrap wound around pipe with adhesive or laminating agents
  - ◆ Typically 2" of wrap must extend beyond damage
  - ◆ Excavation site refilled after mandated curing time
- Reducing pressure improves quality of repair



Source: Armor Plate



# 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



EPA POLLUTION PREVENTER

*Reducing Emissions, Increasing Efficiency, Maximizing Profits*



# 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 pounds per square inch (psi)

Estimate: 16 hours to repair

Cost of labor: Field Labor: 3 men @\$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

$$\text{Volume of methane(Mcf)} = (D^2 * P * (L/1,000) * 0.372) / 1,000$$

$$= 24 * 24 * 350 (52,800 / 1,000) * 0.372 / 1,000$$

$$= 3,960 \text{ Mcf @ } \$3/\text{Mcf}$$

$$= \$11,900$$

Note: for 10 miles between block valves



# Composite Wrap

## Step 4: Calculate Purge Gas Savings

---

Purge Gas saved = Purge Gas used during line replacement

$$\text{Volume of Purge Gas} = [3.14 * D^2 * L / (4 * 144 * 1,000)] * 1.2$$

$$= [3.14 * 24 * 24 * 52,800 / (4 * 144 * 1,000)] * 1.2$$

$$= 200 \text{ Mcf @ } \$4/\text{Mcf of nitrogen}$$

$$= \$800$$

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



EPA POLLUTION PREVENTER

*Reducing Emissions, Increasing Efficiency, Maximizing Profits*

# Composite Wrap

## Step 4(cont'd): Replacement Line Cost

---

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

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

Estimate: 40 hours to repair

Cost of labor: Field labor: 4 men @\$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

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

### INTANGIBLES:

- Safety
- Environmental impacts
- Site access
- Service interruption



# Composite Wrap Partner Experience

---

- 300+ wraps on 10" or greater lines since 1995
- Up to 15 wraps have been butted side-by-side in the U.S.
- 20" defect in line near creek bed: limited environmental exposure, wrapped in 2 hours; total repair 2 days start to finish



# 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
- ❑ 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 Contacts

---

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



EPA POLLUTION PREVENTER

*Reducing Emissions, Increasing Efficiency, Maximizing Profits*