

API 15S Spoolable Composite Pipeline Systems

Pennsylvania Public Utilities Commission
Pipeline Safety Seminar

State College, PA
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DeWitt Burdeaux
Regulatory Affairs
FlexSteel Pipeline Technologies



EXTREME PERFORMANCE VALUED DURABILITY

Presentation Topics

- **Why Use Spoolable Pipe**
- **Spoolable Composite Pipeline Types**
- **Manufacture**
- **Transportation**
- **Installation Methods**
- **Connection Systems**
- **Applicable Standards and Codes**
- **Spoolable Pipe in Jurisdictional Applications**
- **API SC15 Working Group Activities to Revise API 15S**

Why Use Spoolable Pipe?

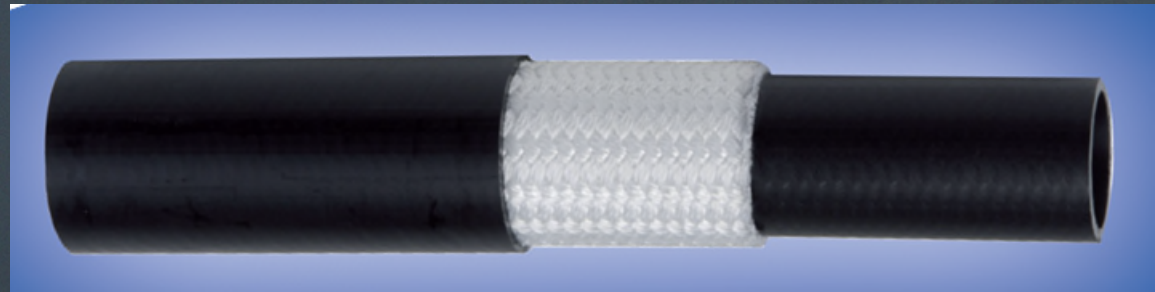
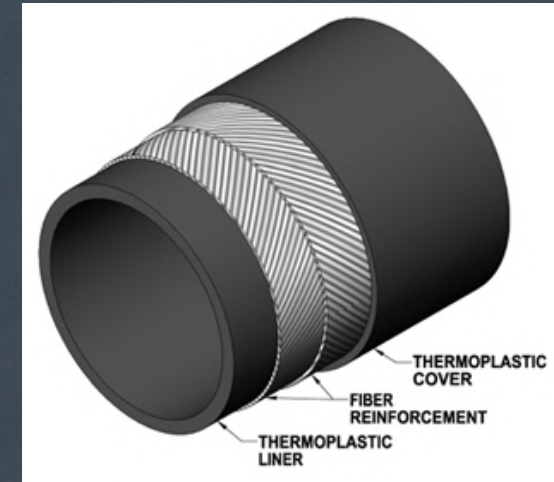
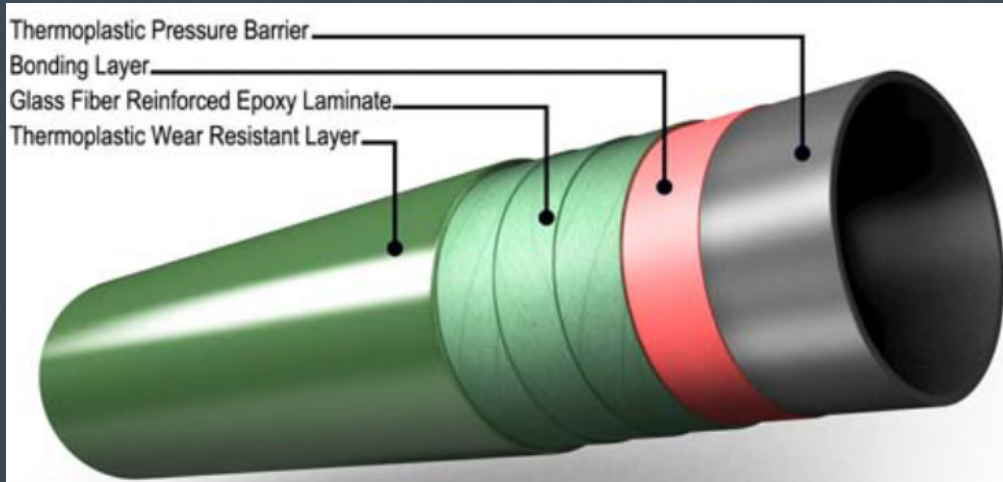
Advantages

- Economic:
 - Install in 40-80% of the time
 - 35-65% lower installed cost than welded steel line pipe
 - Minimal manpower and equipment requirement
 - No welding, field bending, coating or X-ray costs
- Technical
 - Increased Reliability
 - Improved Safety/Environment
 - Corrosion resistance
 - Smaller right of way

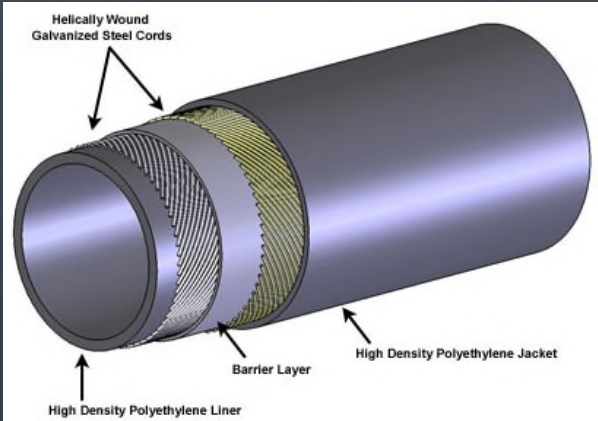
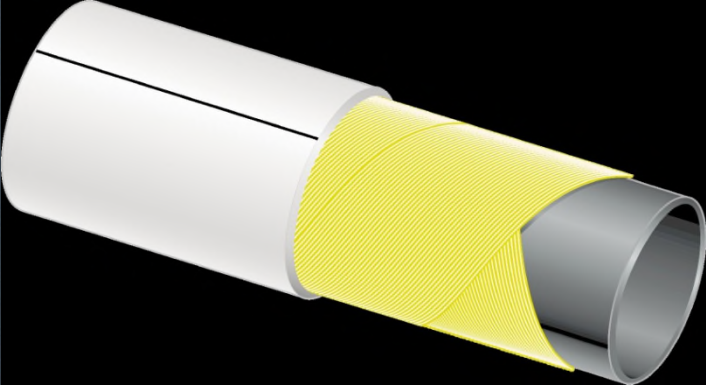
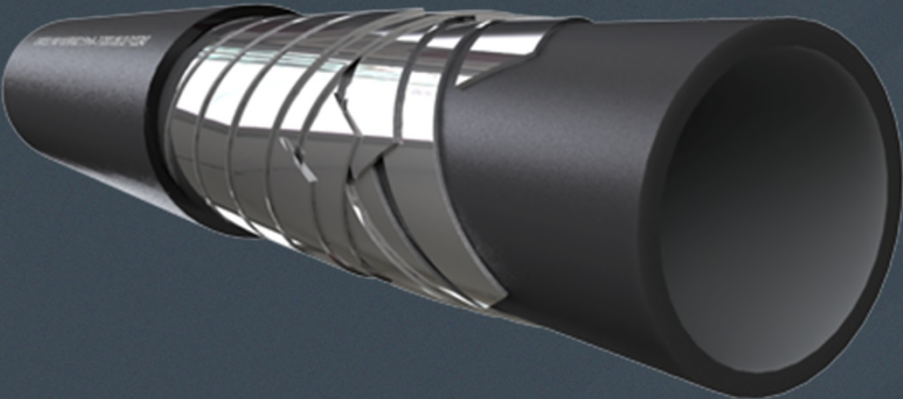
Challenges

- Economic
 - Focus on system & life cycle costs rather than \$/foot
- Technical
 - Reliability data base & Design methodology
 - In-service monitoring
- Emotional
 - Change of culture & Lack of standards
 - Minimal tolerance to introduction of new technology

Spoolable Pipe Structures – Fiber Reinforcement



Spoolable Pipe Structures - Steel Reinforcement

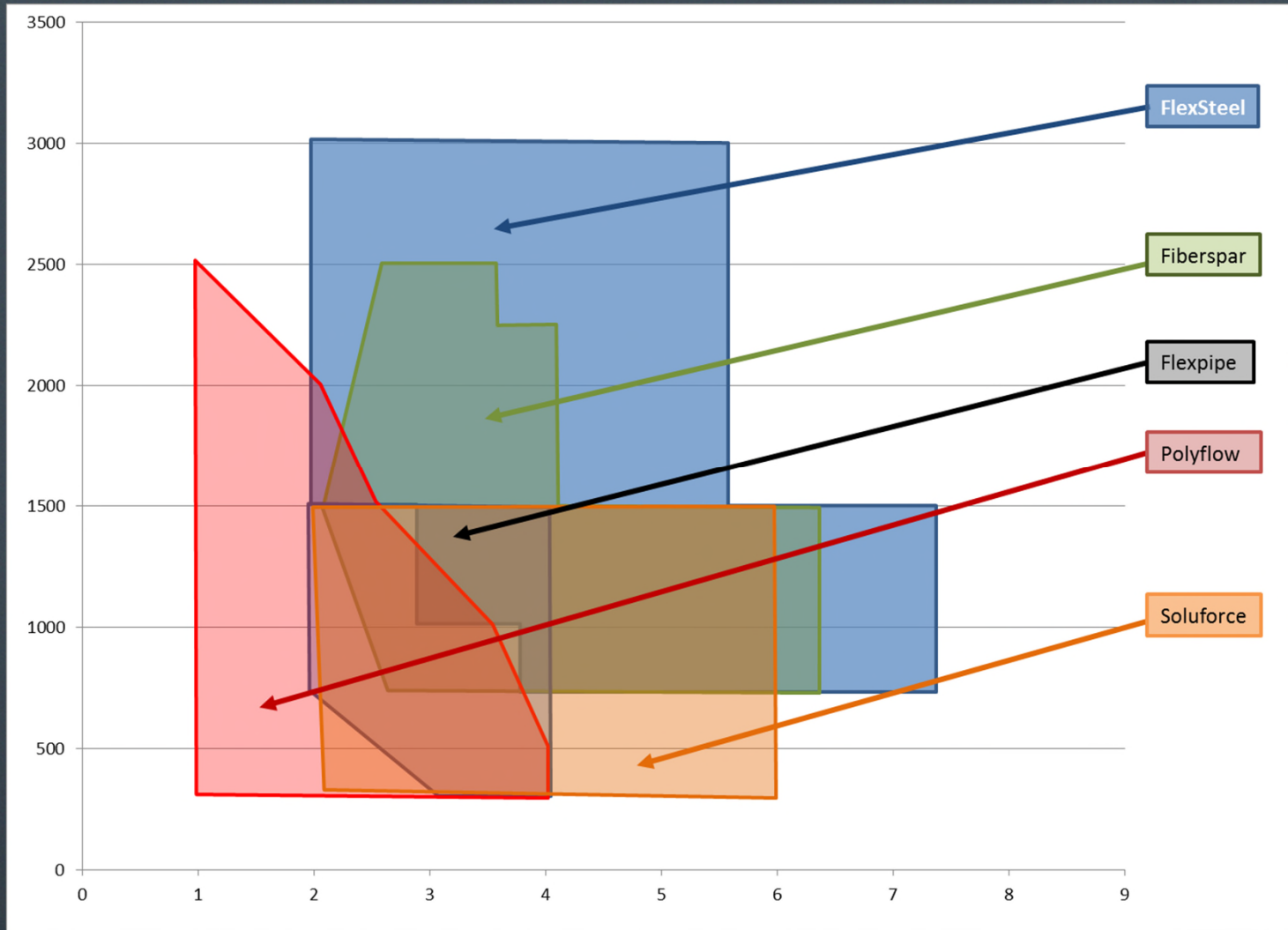


Common Sizes and Operating Pressures

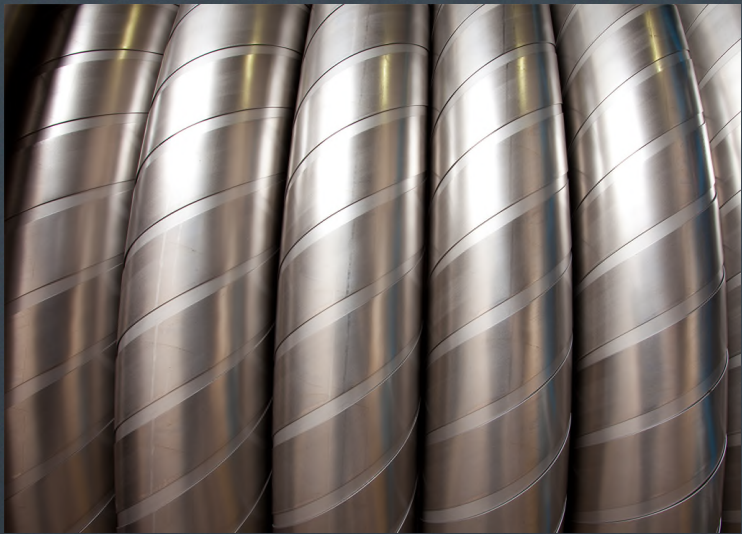


- Diameters from 2 inch to 8 inch
- Pressures 300 PSI to 3,000 PSI

Operating Envelope Comparison

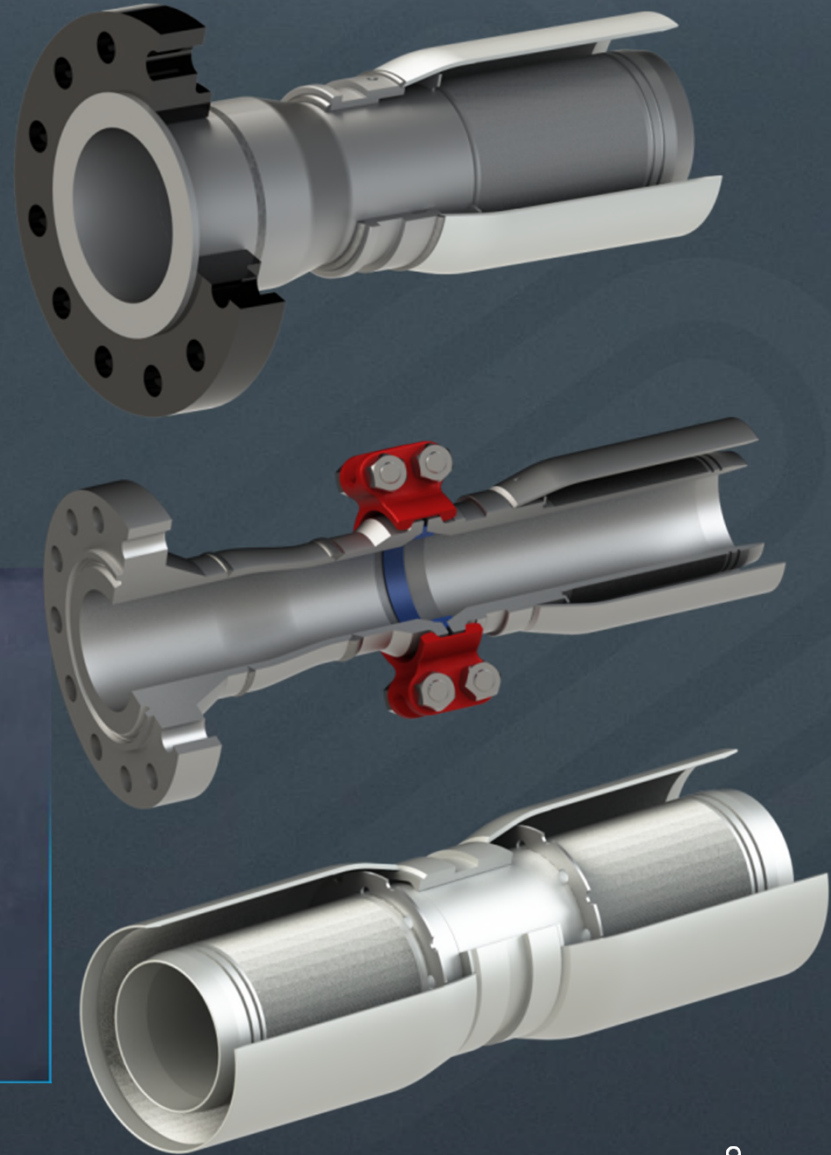
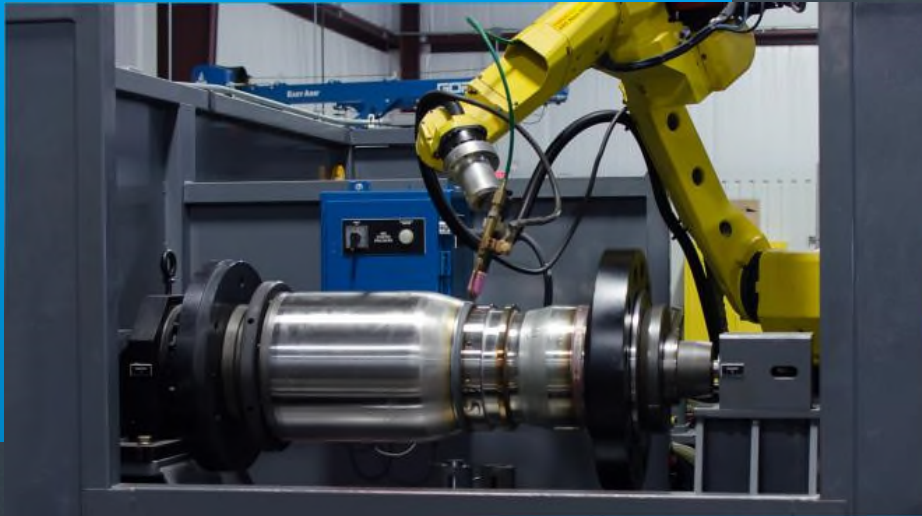


Pipe Manufacture



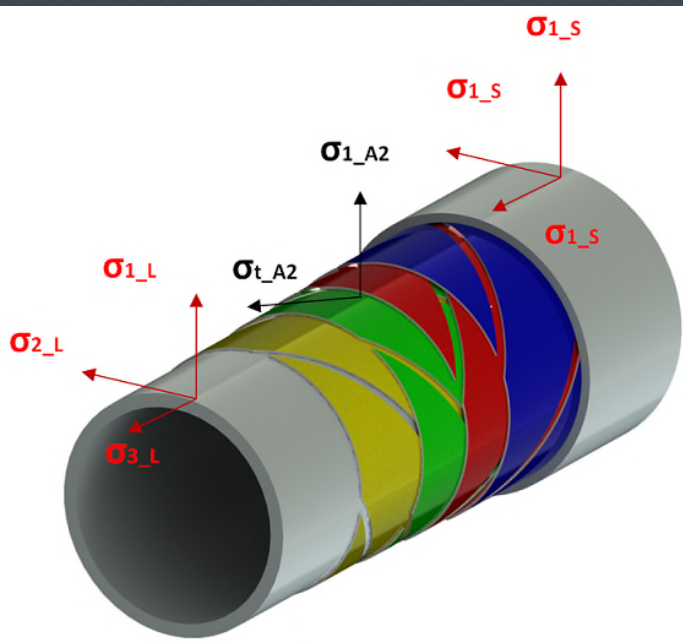
Qualified and Tested Procedures

- Welding procedures for the manufacture of fittings per ASME IX
- Welder qualifications
- Swaging/joining procedures
- HDPE shield repair



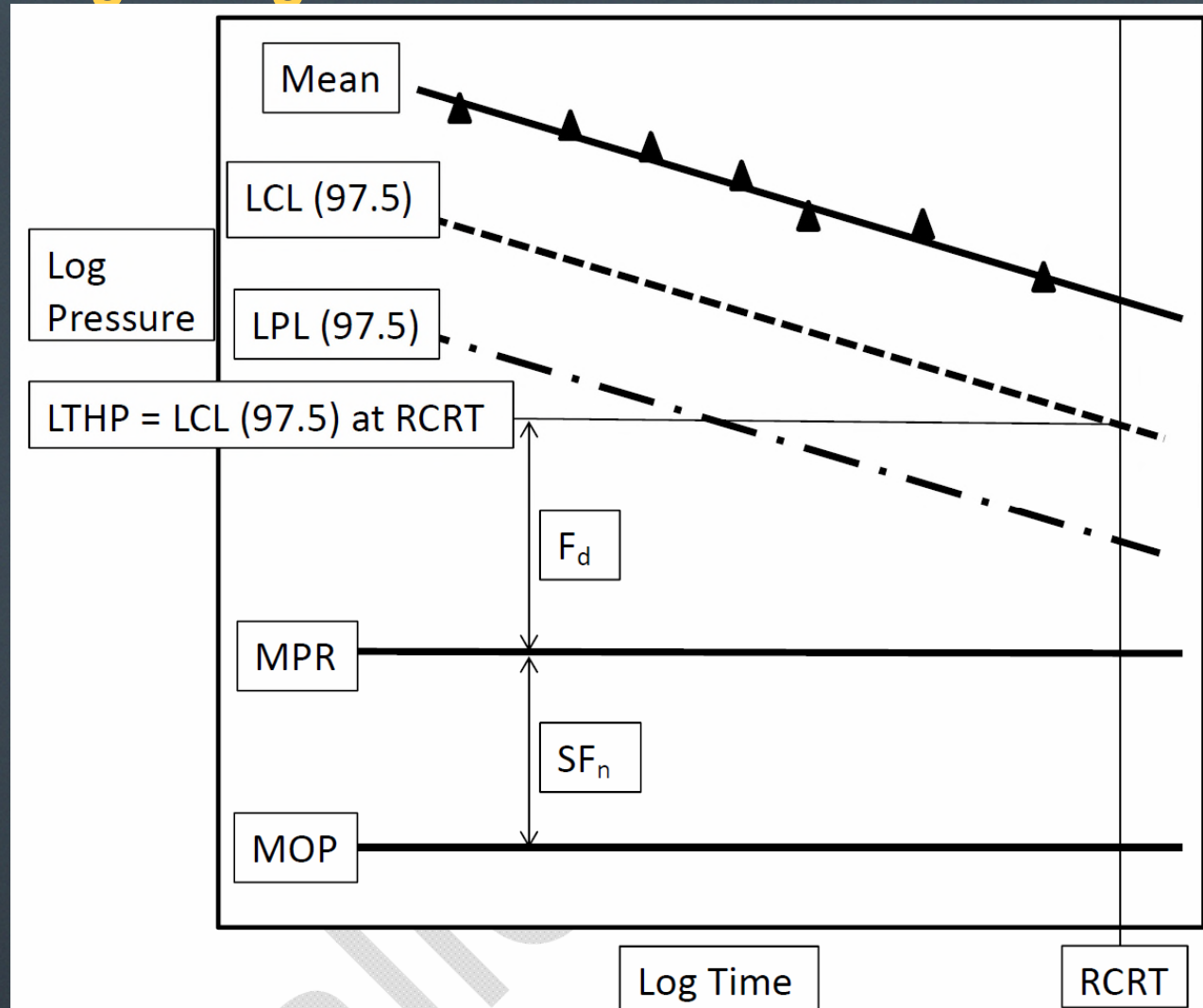
Design

- API 17J requires that the stresses on the metallic layers and strains on the polymer layers be limited to specified values for all of the various loading encountered with flexible steel pipe



PIPE DESIGN	PREDICTED PSI	ACTUAL PSI
8 INCH 1500	3,328	4,105
8 INCH 1000	2,355	3,409
8 INCH 750	1,794	2,687
6 INCH 2250	4,595	5,373
6 INCH 1500	3,189	3,725
4 INCH 3000	6,412	7,146
4 INCH 2250	5,124	5,648
3 INCH 3000	5,871	6,591
3 INCH 2250	4,920	5,693

Establishing a Regression Curve



Transportation



Deployment Equipment



Installation - Trenching

Minimal Equipment
& Crew

Reduced
Right-of-Way

Rapid Deployment



Installation - Plowing

Minimal Ground Disturbance	3x Faster	Up to 4 Miles per Day (6 km)	30% to 50% Cost of Trenching
			

Installation – Pipeline Rehabilitation

Maximum
Operating
Pressure

Fraction of Cost
vs. New Pipeline
Construction

No De-Rating

Superior Tension
for Longer Pulls



Installation – Horizontal Directional Drilling

Overcome
Surface
Challenges

Minimize
Environmental
Impact

Bores in Excess
of 3,000 Feet /
900 Meters

Tough Outer
Shield



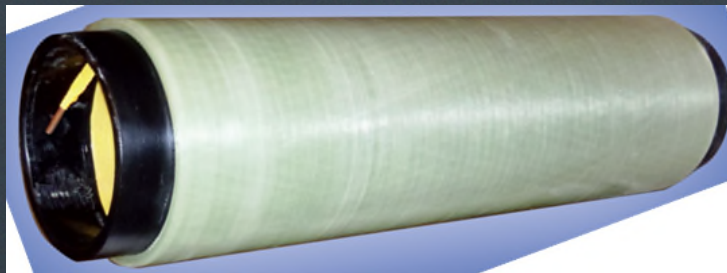
Pipe Locating Technologies

- Similar to HDPE pipe, non-metallic reinforced pipes require tracer wire
- Steel reinforced pipes are electrically continuous and do not require tracer wire



Pipeline Connection Systems

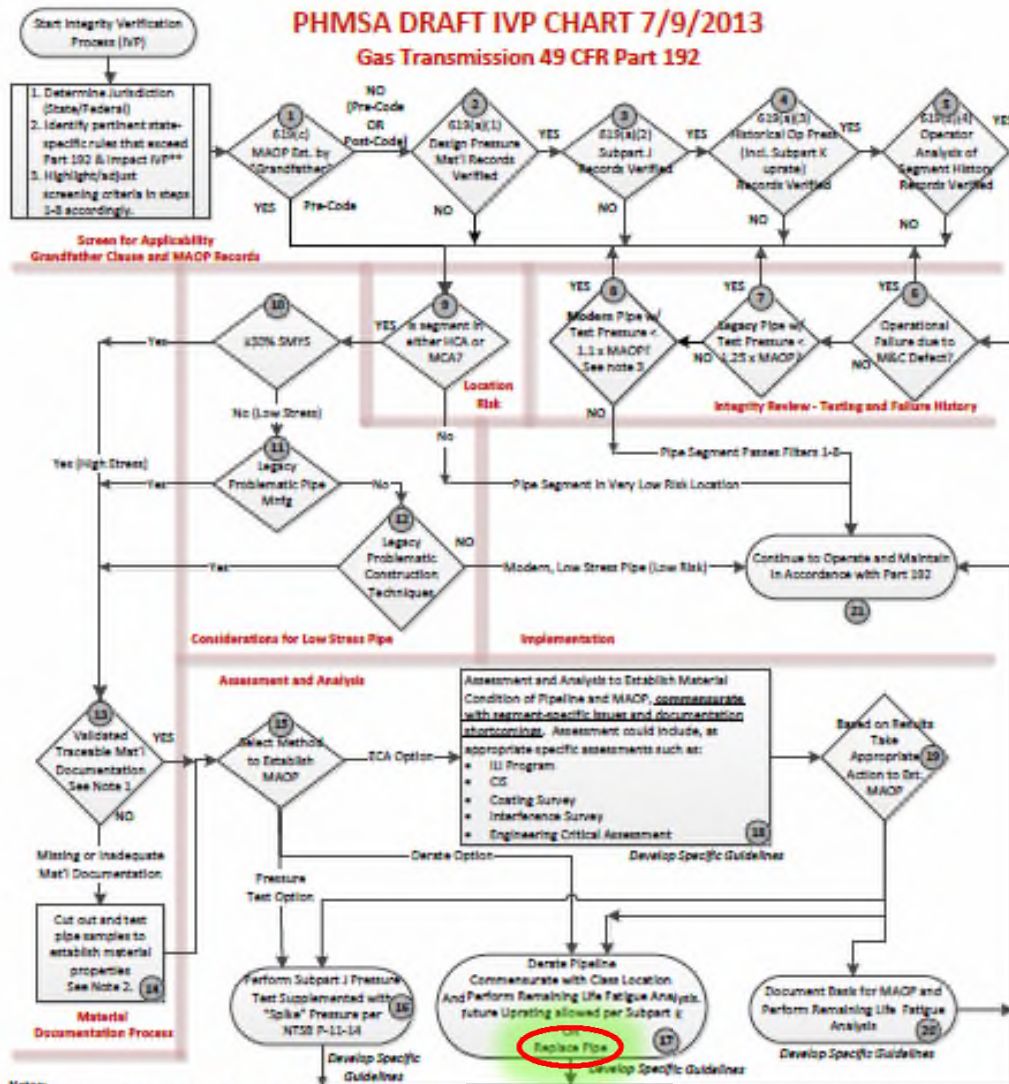
Swage, Crimp, Mechanical, Fusion



Pipeline Integrity Verification Process Workshop

PHMSA DRAFT IVP CHART 7/9/2013

Gas Transmission 49 CFR Part 192



Notes:

Legacy Pipe means LFERW, SSAW, Flash Weld (AD Smith), or pipe w/ joint factor < 1 (e.g., lap welded pipe) regardless of date of manufacture.

Modern Pipe means post-code pipe not manufactured with any techniques listed under Legacy Pipe.

Legacy Problematic Construction Techniques means wrinkle bends, riber > 3 degrees, Dresser Couplings, non-standard fittings, arc welds, oxyacetylene welds, bell spigots, puddle weld repairs, etc.

Moderate Consequence Area (MCA) means non-HCA pipe in Class 4, 3, 2, locations & Class 1 locations with (TSD) houses/sites in PH.

Note 1: Required for Pipe, Fittings, Valves, Flanges & Components.

Note 2: Validated mat'l properties req'd for X42 and greater & pipe > 2"OD if on the mainline.

Note 3: Twice G19(a) to require min. 1.25 MAOP pressure test for new pipe

Note 4: Validation of MAOP per G19(a), Alt MAOP, not considered a problem and not addressed in IVP requirements

Location	PROPOSED DEADLINES FOR COMPLETING INTEGRITY VERIFICATION						
	$\geq 50\%$ SMYS		20 - 50% SMYS		< 20% SMYS		
	Legacy	Modern	Legacy	Modern	Legacy	Modern	
HCA	TBD	TBD	TBD	TBD	TBD	TBD	na
MCA Class 4	TBD	TBD	TBD	TBD	TBD	TBD	na
MCA Class 3	TBD	TBD	TBD	TBD	TBD	TBD	na
MCA Class 2	TBD	TBD	TBD	TBD	TBD	TBD	na
MCA Class 1	TBD	TBD	TBD	TBD	TBD	TBD	na

**Some state requirements exceed Part 192. For example:

- Pressure test at 150% MAOP to establish MAOP, or
- All gas transmission (GT) to be classified and constructed to Class 4 requirements, or
- Define as GT if MAOP > 125 psig, etc.

In Service Monitoring / Integrity Management

Pipe Type	Visual internal/external	Periodic Pressure Test	Annulus Monitoring	CP System Monitoring
Bonded Non-metallic RTP	●	●		
Un-bonded Non-metallic RTP	●	●	●	
Un-bonded Metallic RTP	●	●	●	●

Applicable Standards and Codes

Steel reinforced thermoplastic pipe

- API 17J / 17K / 15S
- ASTM F2805
- CSA Z662
- ISO 18226



Non-metallic reinforced thermoplastic pipe

- API 15HR / 15S
- ASTM F2686
- CSA Z662
- ISO 18226



Materials Recognized by Regulations – Types of Pipe

§192.53 General / Liquids §195.8

- Maintains structural integrity under temperature and other environmental conditions
- Chemically compatible with any gas and any material in which they are in contact
- Qualified in accordance with the applicable requirements of this subpart

§192.55 Steel

- New Steel pipe is qualified under this part IF it was manufactured in accordance with a listed specification



§192.59 Plastic

- New plastic pipe is qualified under this part IF it was manufactured in accordance with a listed specification



PHMSA Rulemaking Discussions

- Petition for rulemaking May 2008 (product specific)
- Special Permits approved
- Suggestion to develop ONE standard for composite pipes
- Four year effort to develop



Spoolable Pipe in Regulated Systems

All Spoolable Composite Pipelines require a special permit

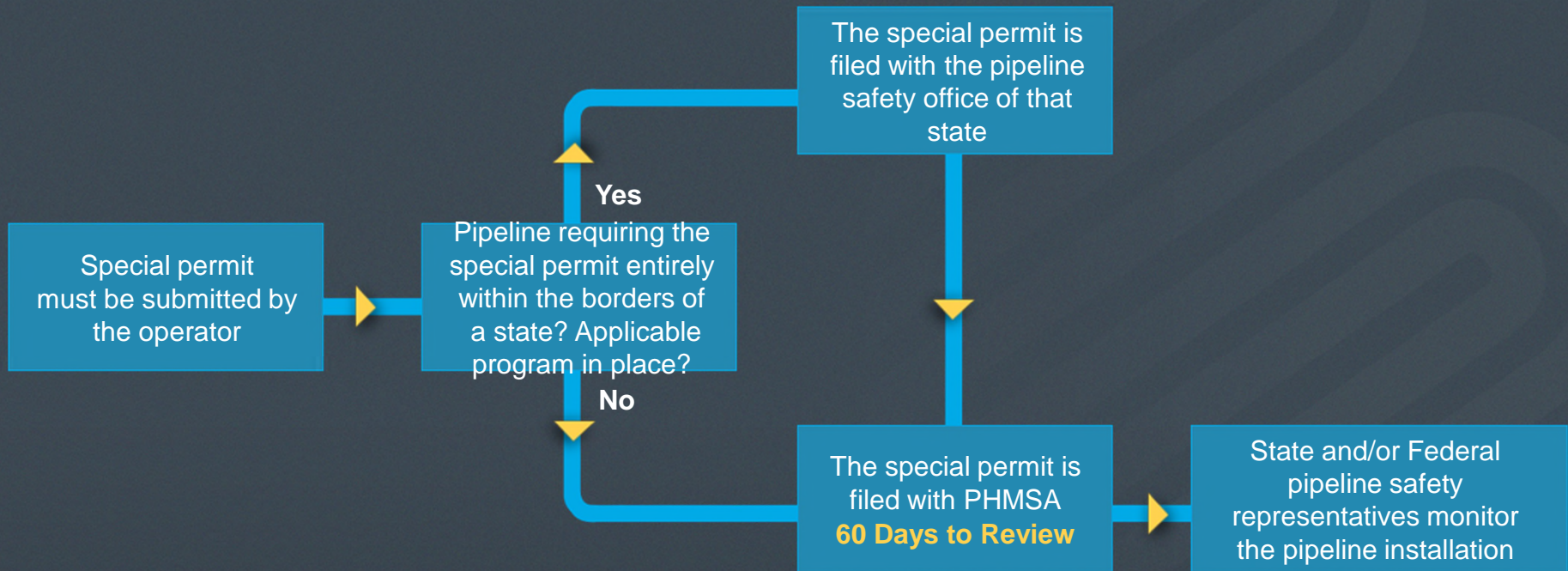
Special Permit Advantages

- Enables PHMSA/State Agencies to monitor new technologies over time

Special Permit Disadvantages

- 90 - 180 days approval cycle is typical and most oil and gas producers cannot accommodate the delay

Special Permit Count is a Leading Indicator to Change in Regulation



3 - 9 Months

Spoolable Pipe in Regulated Systems

Known Special Permits for Spoolable Pipelines

- FlexSteel special permits:
 - TXRRC Gas Services Docket 09813 for use of 25,000 feet 6” FlexSteel to rehabilitate 12” flowline in Texas
 - TXRRC Gas Services Docket 09903 for use of 3” FlexSteel to rehabilitate 6” flowline in Texas
- Fiberspar special permits:
 - Docket RSPA-04-18757 for use of 4,200 feet of 4” Fiberspar in New York
 - Docket PHMSA-2010-0063 for use of 8 miles of 4.5” Fiberspar in Alaska
 - Docket PHMSA-2012-0112 for use of 3 miles of 6” Fiberspar in Alaska
- Smart Pipe special permits:
 - Docket PHMSA-2012-0112 to insert 1.07 miles 6-inch OD Smart Pipe system into the current 12-inch OD segment of the existing steel gas gathering line
- Polyflow Thermoflex special permit
 - TXRRC Gas Services Docket 09995 for use of 5,915 feet 1.25” Thermoflex to rehabilitate 4” flowline in Texas

API SC15 WG02 Spoolable Plastic Line Pipe

SC15 WG02 is tasked with re-writing API RP 15S as a single performance based standard for all spoolable composite pipelines:

- Metal reinforced
- Fiber reinforced with or without matrix material
- Fabric reinforced
- Other materials

The objective is to have a document for spoolable composite pipeline systems that can be incorporated by reference into Part 192 and Part 195

Currently in comment resolution process

History of API 15S Document

1999-2002:

Joint Industry Project (JIP) on “Implementation of Reinforced Thermoplastic Pipes in the Oil and Gas Industries”

**Professor Geoff Gibson, Centre for Composite Materials Engineering,
University of Newcastle upon Tyne**

2002- 2004:

**ISO Working Group, ISO/TC138/SC4/WG8 produced ISO TS 18226 (2004),
Reinforced Thermoplastic Piping Systems for Gaseous Fuels**

2006:

API RP 15S 1st Edition, Qualification of Spoolable Reinforced Plastic Line Pipe

2011:

Working Group initiated to rewrite 15S as an API Specification

TG02/WG02: Spoolable Plastic Line Pipe Members

Approximately 30 Members:

- Manufacturers:



- End Users:



- Suppliers/Labs:



- Trade Associations:



- Regulatory:



- Independent Consultants



Timeline for Remaining Activities

- **SC 15 Ballot completed**
 - 400+ comments
 - ~275 comments reviewed to date
- **Anticipated Publication in mid 2015**
- **PHMSA – Petition for rulemaking**
 - PHMSA “urging” Special Permits requests
 - Development of ANPRM

Q and A