



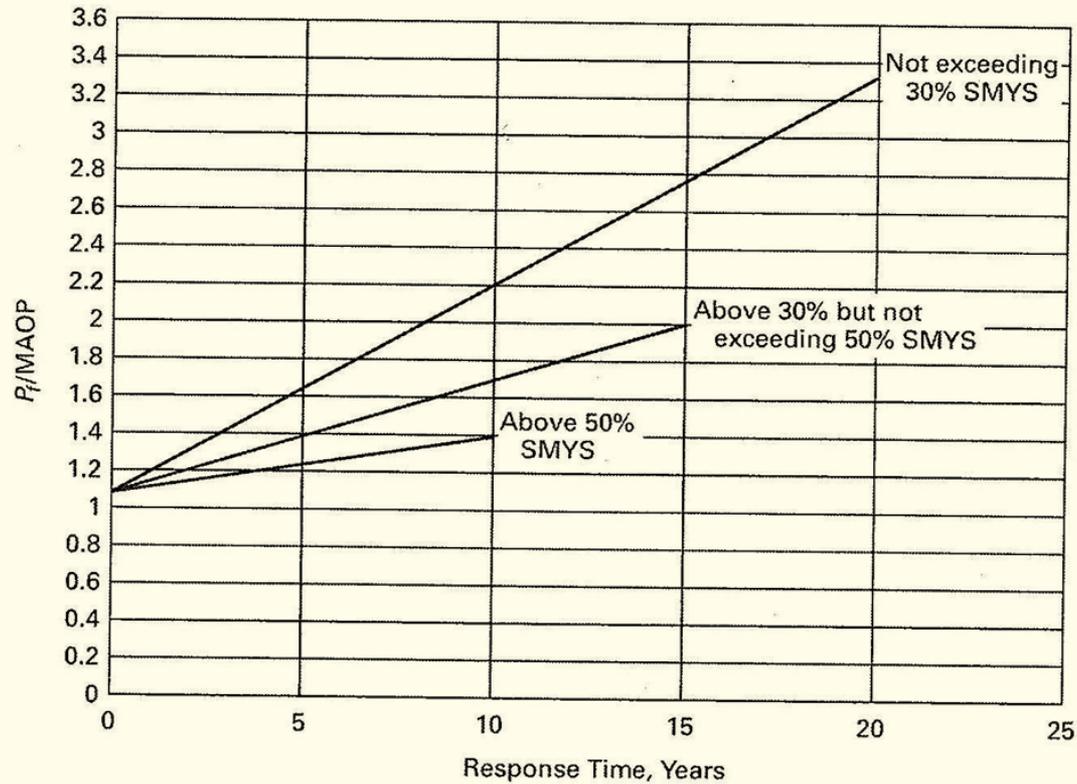
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# REMEDICATION REQUIREMENTS: AN OPERATOR'S VIEWPOINT

# Criteria from B31.8S

- Scheduling responses
  - Immediate – at failure point
    - $P_f < 1.1 \times \text{MAOP}$
  - Scheduled – significant, but not at failure point
    - $1.1 \times \text{MAOP} < P_f < 1.39 \times \text{MAOP}$
  - Monitored – ok until next inspection
    - $P_f > 1.39 \times \text{MAOP}$
- What to do where

# Criteria from B31.8S



**Fig. 4 Timing for Scheduled Responses: Time-Dependent Threats, Prescriptive Integrity Management Plan**

# Criteria from B31.8S

**Table 4 Acceptable Threat Prevention and Repair Methods**

Prevention, Detection, and Repair Methods	Third-Party Damage			Corrosion Related		Equipment				Incorrect Operation	Weather Related			Manufacture		Construction			O-Force	Environ- ment		
	TPD(IF)	PDP	Vand	Ext	Int	Gask/ Oring	Strip/ BP	Cont/ Rel	Seal/ Pack	IO	CW	L	HR/F	Pipe Seam	Pipe	Gweld	Fab			EM	SCC	
																	Weld	Coup	WB/B			
<b>Prevention/Detection</b>																						
Aerial patrol	X	X	X	...	...	...	...	...	...	...	X	X	X	...	...	...	...	X	...	X	...	
Foot patrol	X	X	X	X	...	...	...	...	...	...	X	X	X	...	...	...	...	X	...	X	...	
Visual/mechanical inspection	...	...	...	...	...	X	X	X	X	...	X	...	...	...	...	X	...	...	...	...	...	
One-call system	X	X	X	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Compliance audit	...	...	...	...	...	...	...	...	...	X	...	...	...	...	...	...	...	...	...	...	...	
Design specifications	...	...	...	X	X	X	X	X	X	...	...	...	...	...	...	X	...	X	X	X	X	
Materials specifications	...	...	...	...	...	X	X	X	X	...	...	...	...	X	X	...	X	...	...	...	...	
Manufacturer inspection	...	X	...	...	...	...	...	X	X	...	...	...	...	X	X	...	X	...	...	...	...	
Transportation inspection	...	X	...	...	...	...	...	...	...	...	...	...	...	X	X	...	...	...	...	...	...	
Construction inspection	...	X	...	...	...	X	X	X	X	...	...	...	...	...	X	X	X	X	X	X	...	
Preservice hydrostatic test	...	X	...	...	...	...	...	...	...	...	...	...	...	X	X	X	X	X	X	...	...	
Public education	X	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
O&M procedures	...	X	X	X	X	X	X	X	X	X	X	...	X	...	...	...	...	X	X	X	X	
Operator training	...	...	...	...	...	...	...	...	...	X	...	...	...	...	...	...	...	...	...	...	...	
Increase marker frequency	X	X	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Strain monitoring	...	...	...	...	...	...	...	...	...	...	...	...	X	...	...	...	...	...	...	X	...	
External protection	X	X	X	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	X	...	
Maintain ROW	X	X	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	X	...	
Increased wall thickness	X	X	X	X	X	...	...	...	...	...	...	...	...	...	...	...	...	...	...	X	...	
Warning tape mesh	X	X	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
CP monitor/maintain	...	...	...	X	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	X	
Internal cleaning	...	...	...	...	X	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Leakage control measures	...	X	X	X	X	X	X	X	X	...	...	...	...	...	...	...	...	X	...	...	...	
Pig-GPS/strain measurement	...	...	...	...	...	...	...	...	...	...	X	...	X	...	...	...	...	...	...	X	...	
Reduce external stress	...	...	...	...	...	...	X	...	...	...	...	...	...	...	...	...	...	X	X	X	X	
Install heat tracing	...	...	...	...	...	...	...	...	...	...	X	...	...	...	...	...	...	...	...	...	...	
Line relocation	X	...	X	...	...	...	...	...	...	...	X	...	X	...	...	...	...	...	...	X	...	
Rehabilitation	...	X	...	X	X	...	...	...	...	...	...	...	...	...	...	...	...	X	X	X	X	
Coating repair	...	...	...	X	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	X	
Increase cover depth	X	...	X	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	X	...	...	
Operating temperature reduction	...	...	...	...	...	X	...	...	X	...	...	...	...	...	...	...	...	...	...	...	X	
Reduce moisture	...	...	...	...	X	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Biocide/inhibiting injection	...	...	...	...	X	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Install thermal protection	...	...	...	...	...	...	...	...	...	...	X	...	...	...	...	...	...	...	...	...	...	

# Criteria from B31.8S

**Table 4 Acceptable Threat Prevention and Repair Methods (Cont'd)**

Prevention, Detection, and Repair Methods	Corrosion Related					Equipment				Incorrect Operation	Weather Related			Manufacture		Construction				O-Force	Environ- ment	
	Third-Party Damage		Vand	Ext	Int	Gask/ Oring	Strip/ BP	Cont/ Rel	Seal/ Pack		IO	CW	L	HR/F	Pipe		Fab				EM	SCC
	TPD(IF)	PDP								Pipe Seam					Pipe	Gweld	Weld	Coup	WB/B			
Repairs																						
Pressure reduction	...	X	...	X	X	...	...	...	...	...	...	...	...	X	X	X	X	X	...	...	...	X
Replacement	...	X	X	X	X	X	X	X	X	...	X	X	X	X	X	X	X	X	X	X	X	X
ECA, recoat	...	...	...	X	X	...	...	...	...	...	...	...	...	...	...	X	...	...	...	...	...	...
Grind repair/ECA	...	X	X	...	...	...	...	...	...	...	...	...	...	X	X	X	X	...	...	...	...	X
Direct deposition weld	...	...	X	X	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Type B, pressurized sleeve	...	X	X	X	X	...	...	...	...	...	...	...	...	X	X	...	X	X	...	...	...	X
Type A, reinforcing sleeve	...	X	X	X	...	...	...	...	...	...	...	...	...	X	X	...	...	...	...	...	...	X
Composite sleeve	...	...	...	X	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Epoxy filled sleeve	...	X	X	X	...	...	...	...	...	...	...	...	...	X	X	X	X	X	X	...	...	...
Mechanical leak clamp	...	...	...	X	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

GENERAL NOTE: The abbreviations found in Table 4 relate to the 21 threats discussed in para. 5. Explanations of the abbreviations are as follows:

- Cont/Rel = Control/Relief Equipment Malfunction
- Coup = Coupling Failure
- CW = Cold Weather
- EM = Earth Movement
- Ext = External Corrosion
- Fab Weld = Defective Fabrication Weld
- Gask/Oring = Gasket or O-Ring
- Gweld = Defective Pipe Girth Weld
- HR/F = Heavy Rains or Floods
- Int = Internal Corrosion
- IO = Incorrect Operations Company Procedure
- L = Lightning
- PDP = Previously Damaged Pipe (delayed failure mode)
- Pipe = Defective Pipe
- Pipe Seam = Defective Pipe Seam
- SCC = Stress Corrosion Cracking
- Seal/Pack = Seal/Pump Packing Failure
- Strip/BP = Stripped Thread/Broken Pipe
- TPD(IF) = Damage Inflicted by First, Second, or Third Parties
- Vand = Vandalism
- WB/B = Wrinkle Bend or Buckle

# Requirements from CFR

49 CFR 192.713 Permanent field repair

- (a)(1) Cut out and replace
- (a)(2) Use method shown by engineering tests and analyses to permanently restore the serviceability of the pipe.

49 CFR 192.715 Field repair of welds

- Per 192.245
- Full encirclement welded split sleeve

# Requirements from CFR

## 49 CFR 192.717 Field repair of leaks

- Cut out as cylinder
- Welded split sleeve
- Method shown by engineering tests and analyses to permanently restore serviceability
- Under some conditions
  - Bolt-on leak clamp
  - Welded patch
  - Mechanical sleeve

# Requirements from CFR

49 CFR 192.719 Testing of repairs

- Replacement pipe previously pressure tested
- Repairs by welding examined per §192.241

# Challenges

- Realistic detection, characterization, severity determination
- Timing requirements
- Range of repair methods
- Adequacy of analyses and tests
- Standards for implementation
- Testing and acceptance criteria
- Assurance of permanence

# Opportunities

- Analytical techniques confirmed for
  - Variety of threat conditions
  - Wider range of pipe materials / grades
  - Wider range of metal loss defects
  - Dents
    - Plain
    - With corrosion metal loss
    - With mechanical damage
- Repair technologies
  - Permanent
  - Readily applicable

# Balance of the Session

- More background presentations  
and
- Roundtable discussions  
to
- Develop a prioritized list of needs that:
  - Can be addressed by technology / R&D
  - Will produce improvements in pipeline safety