

ANOMALY EVALUATION AND REPAIR

Evaluation Methods Available for Use with ILI Results

**Application of Safety
Factors in Making
Excavation and Repair
Decisions**

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ANOMALY EVALUATION AND REPAIR SAFETY FACTORS

- Regulatory Requirements
 - 192.485 and 192.713
 - “...permanently restore serviceability of the pipe....”
- This means
 - *The standard we proposed was that the repair method be able to “permanently restore the serviceability of the pipe,” a result comparable to that expected from replacing damaged pipe or installing a full-encirclement split sleeve.*
 - 64 FR 69665 (12/14/99)



ANOMALY EVALUATION AND REPAIR SAFETY FACTORS

- Regulatory Requirements

- 192.485

- “Each segment of transmission line with general corrosion and with a remaining wall thickness less than that required for the MAOP of the pipeline must be replaced or the operating pressure reduced commensurate with the strength of the pipe based on actual remaining wall thickness ...” (emphasis added)*

- This means

- Remaining wall thickness must be adequate to qualify the pipeline to operate at MAOP (i.e., $P_{safe} > MAOP$)

- P_{safe} (also called P' in B31G) includes appropriate design/safety factor (F) : $P_{safe} = P_f / F$



ANOMALY EVALUATION AND REPAIR

SAFETY FACTORS

- Pipeline MAOP determined by LOWER of:
 - 192.619(a)(1) Design pressure of the weakest element in the segment (est. per 192.105)
 - Includes Design Factor (per 192.111)
 - 192.619(a)(2) Pressure Test
 - Includes Safety Factor in Class Location Table
 - 192.619(a)(3) 5 year operating history before eff date
 - N/A to evaluating damaged pipe
 - 192.619(a)(4) Determined by Operator
 - “The pressure determined by the operator to be the maximum safe pressure after considering the history of the segment, particularly known corrosion and the actual operating pressure.”



ANOMALY EVALUATION AND REPAIR SAFETY FACTORS

- “...maximum safe pressure after considering ... known corrosion...” means
 - Calculating P_{safe} (or P'), which includes:
 - Application of Applicable Safety Factors per B31G/RSTRENG

“When used with a factor of safety of 1.39 (equivalent to a hydrostatic test to 100 percent of SMYS for a pipeline operating at 72 percent of SMYS), the modified criterion provides an adequately safe indication of the integrity of a corroded pipe.”
(emphasis added)

John F. Kiefner & P. H. Vieth; A Modified Criterion for Evaluating the Remaining Strength of Corroded Pipe, 12/22/89, p. 46



ANOMALY EVALUATION AND REPAIR SAFETY FACTORS

- In Every Instance
 - Appropriate Safety Factor Must Be Considered
 - Pipe May Not Be Left In Service (Unrepaired) That Would Not Qualify to Operate at MAOP per 192.619
 - The Serviceability of the Pipe Must Be Permanently Restored
 - Correct Cause of Corrosion to Preclude Recurrence or Ongoing Active Corrosion, and
 - Replace, Repair, or De-rate (Reduce MAOP)



ANOMALY EVALUATION AND REPAIR

PROPOSED NON-HCA REPAIR CRITERIA

- Draft proposal for natural gas pipelines
- Investigation and repair criteria for non-HCAs (no special permit)

Location	Class Location	%SMYS	Immediate		1 Year		Monitored	
			FPR	Wall Loss	FPR ^L	Wall Loss	FPR	Wall Loss
Non-HCA	1	≤72%	≤1.1	≥80%	≤1.39	≥60%	>1.39	<60%
Non-HCA	2	≤60%	≤1.1	≥80%	≤1.67	≥60%	>1.67	<60%
Non-HCA	3	≤50%	≤1.1	≥80%	≤2.00	≥60%	>2.00	<60%
Non-HCA	4	≤40%	≤1.1	≥80%	≤2.50	≥60%	>2.50	<60%

L Criteria of 1.39, 1.67, 2.00 & 2.50 equate to class location factors of 0.72, 0.60, 0.50 & 0.40.



ANOMALY EVALUATION & REPAIR: Panel Discussion

Individual Panelist Presentations

