WELCOME

Bill Gute

Deputy Associate Administrator for Pipeline Safety

October 22, 2008

WELCOME

- I want to thank all the presenters and panelist for participating and the audience for coming.
- There is a lot of passion and energy regarding today's topics. I ask everyone to make all comments in a business like manner.

PURPOSE

- PHMSA'S role is to ensure a safe, reliable and environmentally friendly pipeline transportation network
- We apply risk and leverage data to ensuring pipeline safety
- This meeting will assist PHMSA in data gathering efforts

Purpose

- Move discussions on anomaly assessment and repair to a public forum
- Present research results
- Gather input on assessment and repair processes to provide guidance to regulators and industry
- Add clarity to expectations contained in regulations; in particular outside HCA's

Impacts

- Safety
- Cost
- Operations and maintenance plans
- Research
- Transmission and distribution
- Gas and liquids operators

Meeting Management

- Emergencies
- Quiet cell phones
- Please be on time
- Lunch options

AGENDA OVERVIEW

Alan Mayberry
PHMSA Director of Engineering & Emergency Support

October 22, 2008

AGENDA OVERVIEW
BACKGROUND

- PHMSA and PRCI Contracted with Advantica to Study Reliability of Pf Calculation Methods
- Report Issued 10 October 2008
- [insert URL for download]

AGENDA OVERVIEW
BACKGROUND

- PHMSA has been in discussions with INGAA and natural gas operators on anomaly assessment and repair requirements
- Requirements developed for special permits, and we have worked to add clarity to PHMSA expectations outside of HCA's

AGENDA OVERVIEW

Today's Program

- Overview of the Advantica Study
  - Bryan Lethcoe, Advantica
  - Steve Stout, Cycla Corp.
- Industry Perspective: Anomaly Evaluation Issues and the Advantica Study
  - Terry Boss, INGAA

AGENDA OVERVIEW

Today's Program

- International Perspective
  - Rafael Mora, National Energy Board of Canada
- Anomaly Repair Panel Discussions
  - Tool Tolerances
  - Corrosion Growth Rates
  - Anomaly Repair and Evaluation
- Comments, Summary, Next Steps

AGENDA OVERVIEW
Key Questions

Implications of the Advantica Study

- Do repair and evaluation strategies need to be changed for:
  - High strength steels (X60 and above)?
  - Anomaly depth ≥ 60% through wall?

AGENDA OVERVIEW
Key Questions

- What safety factors should be used in evaluating ILI results?
  - HCA
  - Non-HCA
  - Pipe operated under Special Permit
  - Class location change pipe

AGENDA OVERVIEW

Key Questions

- Are the following considerations being consistently applied to provide adequate safety margins?
  - tool tolerance
  - corrosion growth rate
  - external stresses
  - overpressure protection

AGENDA OVERVIEW

Finally….

- Summarize at the end
- Presentations and comments will help shape our path forward

AGENDA OVERVIEW
Next

- Overview of the Advantica Study

EVALUATION OF ADVANTICA STUDY RESULTS

A Review Of Methods for Assessing the Remaining Strength of Corroded Pipelines

STEVE STOUT

OCTOBER 22, 2008

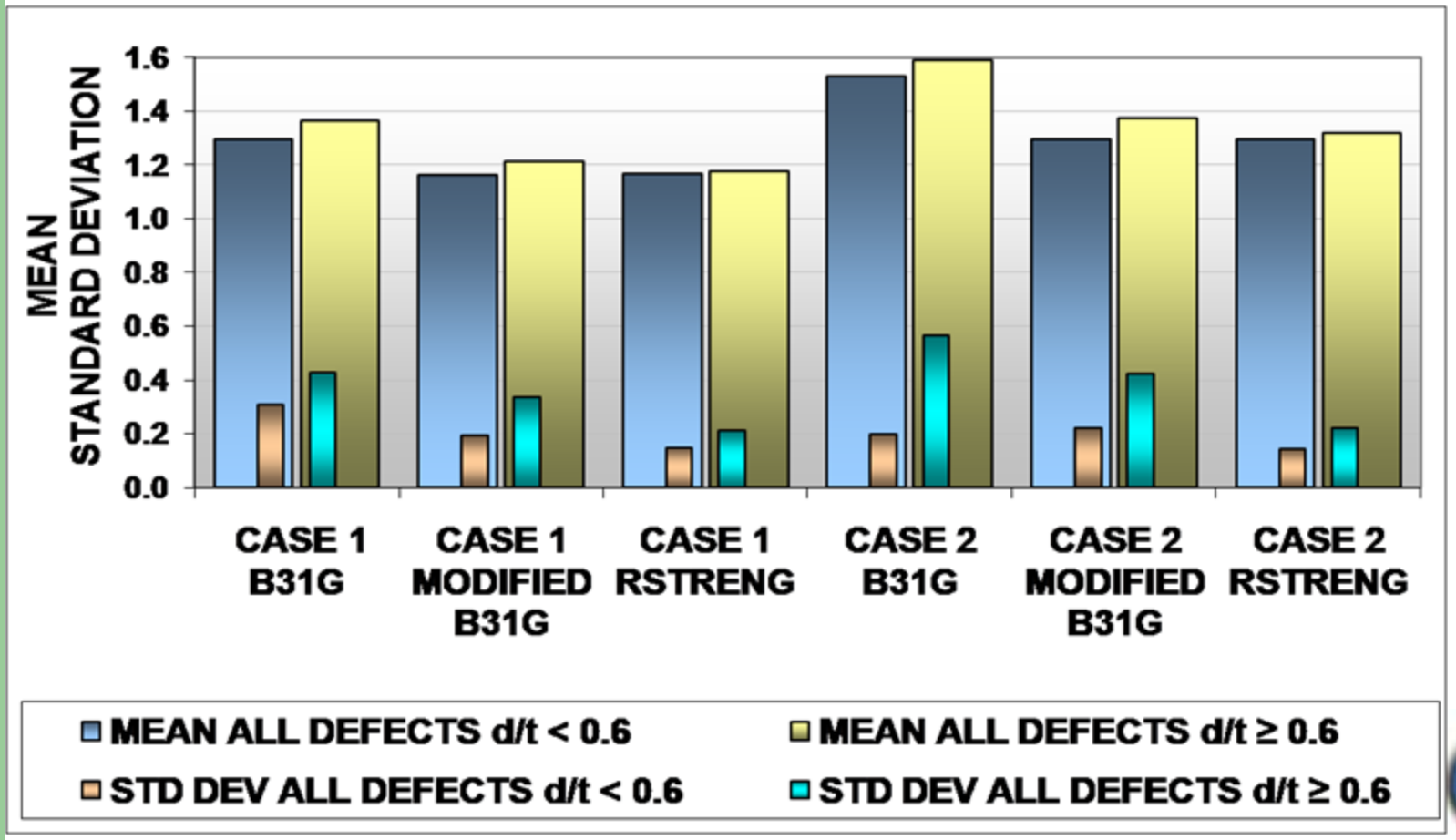
PHMSA EVALUATION
PURPOSE

- Evaluate ASME B31G, Mod B31G, and RSTRENG results reported by Advantica
- Evaluate expected reliability of B31G, Mod B31G, and RSTRENG
- Determine conditions more likely to produce non-conservative Pf
- Compare Case 1 vs. Case 2 Results

PHMSA EVALUATION
TARGET RELIABILITY

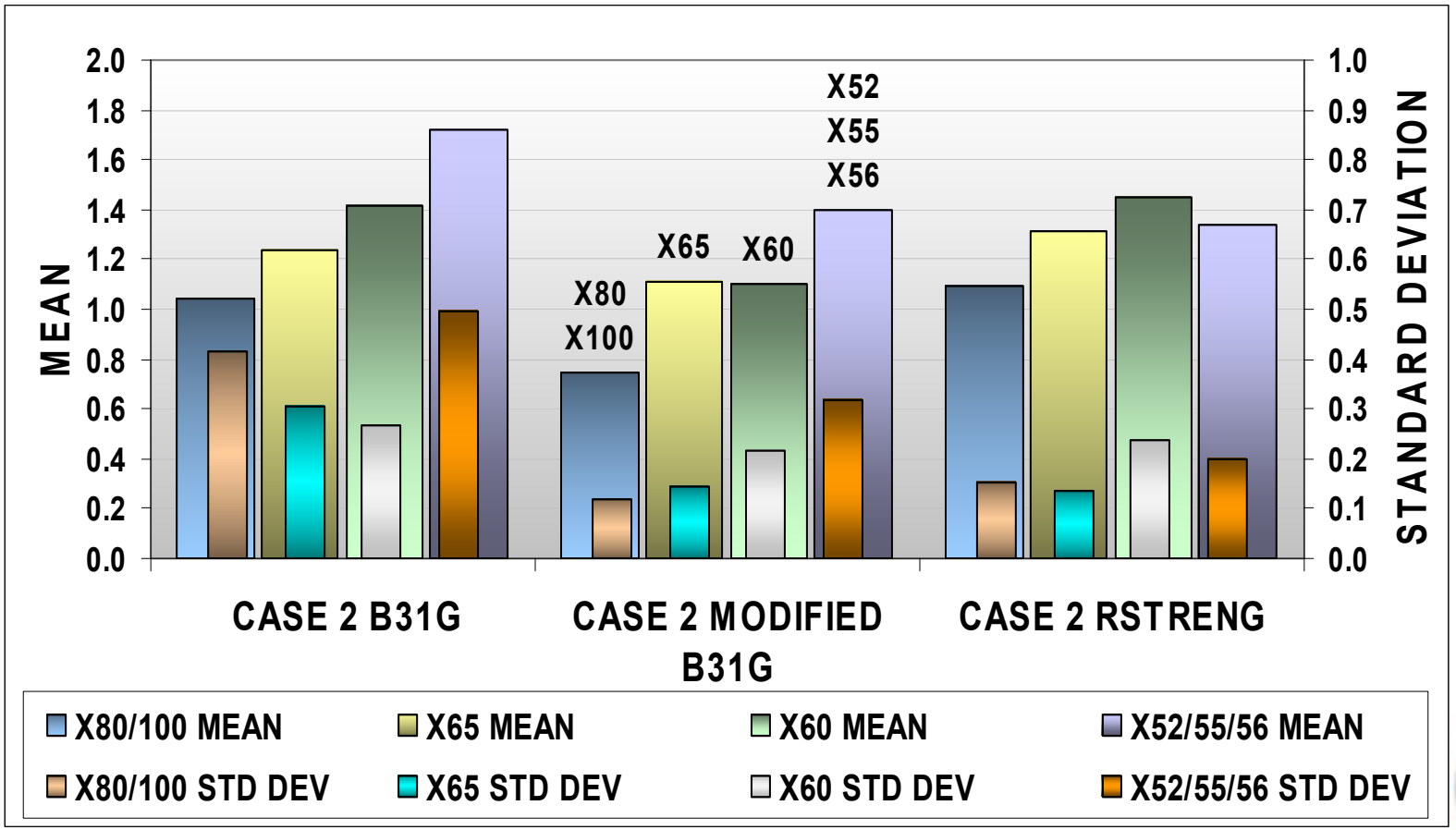
- Target for reliable prediction of conservative Pf
- Confidence level of 95%

MEAN OF Pa/Pf WITH STANDARD DEVIATION

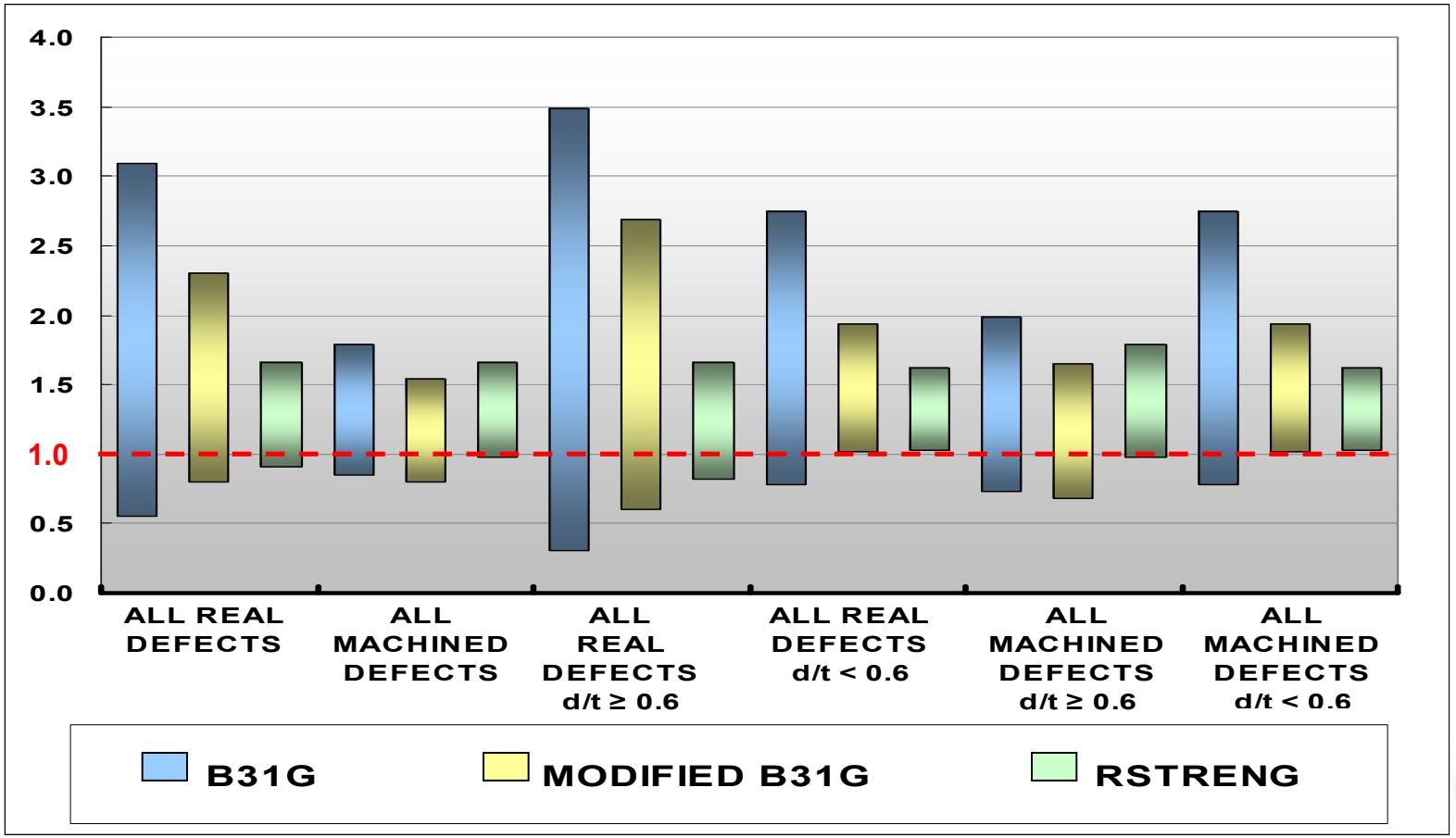


SAMPLE MEAN OF Pa/Pf WITH STANDARD DEVIATION

d/t ≥ 0.6 by Pipe Grade

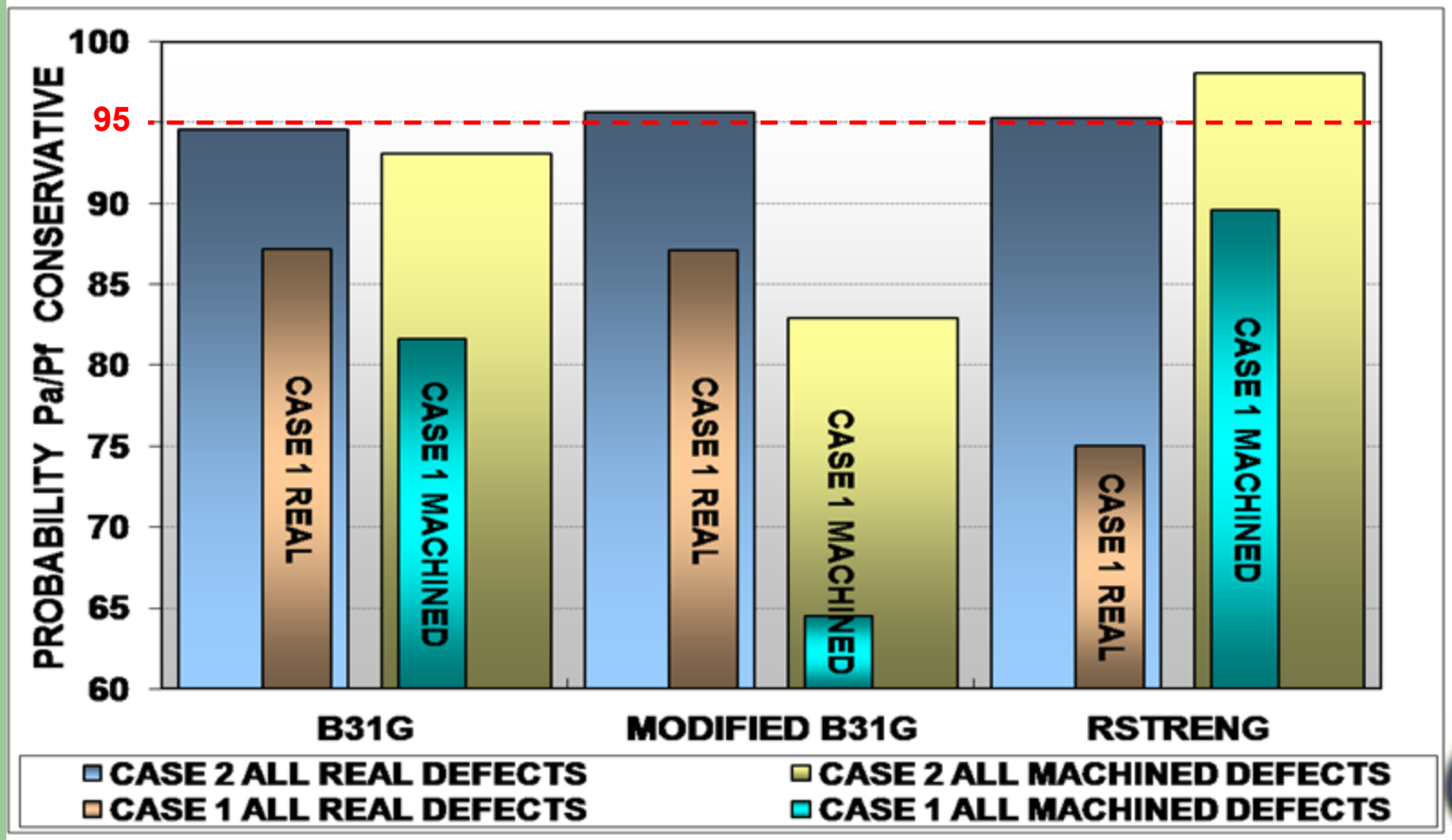


CASE 2
RANGE OF Pa/Pf WITHIN TWO STANDARD DEVIATIONS OF THE MEAN
~ 95 % OF SAMPLE DATA POINTS



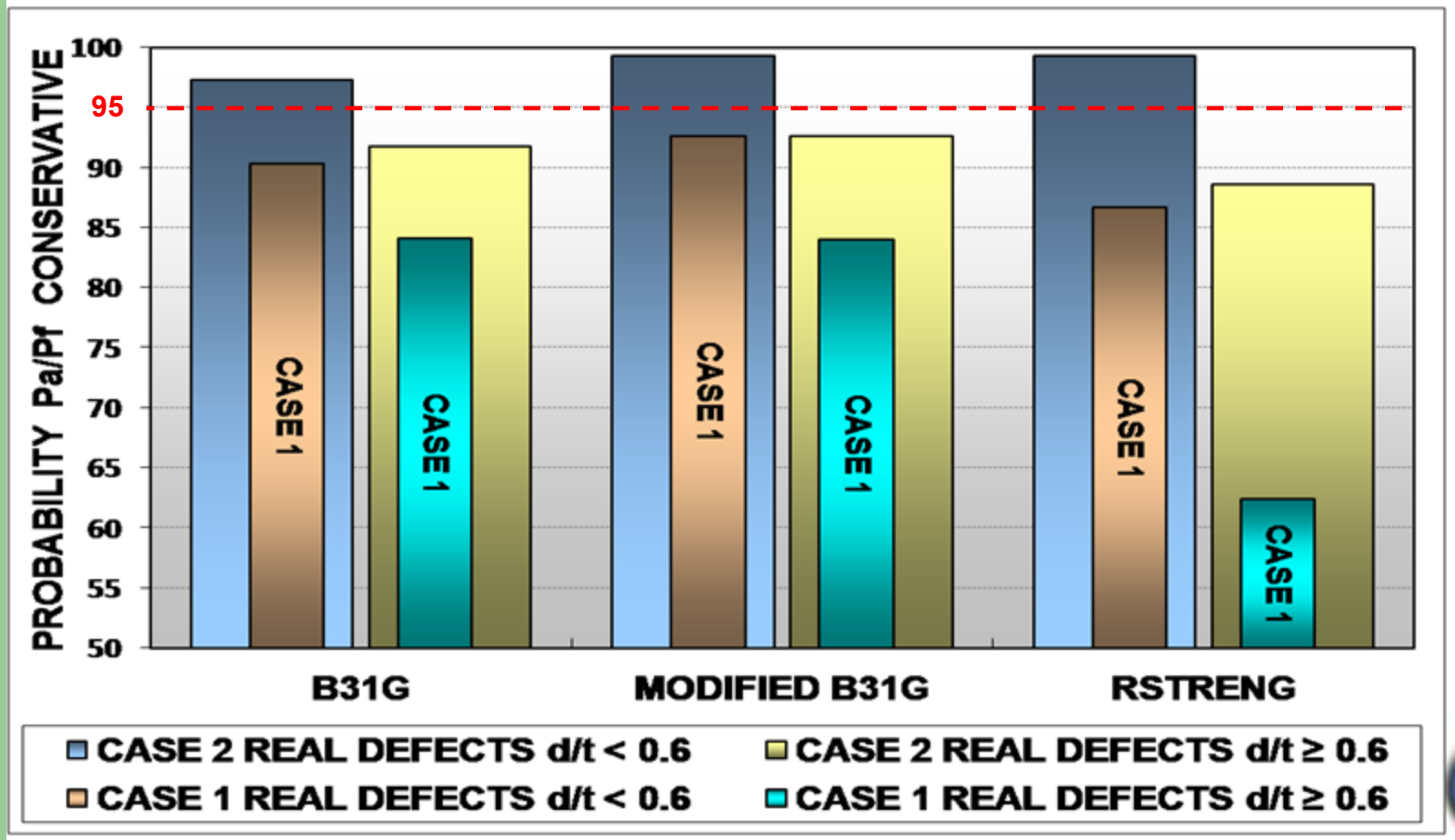
PROBABILITY THAT Pa/Pf IS CONSERVATIVE

REAL vs. MACHINED



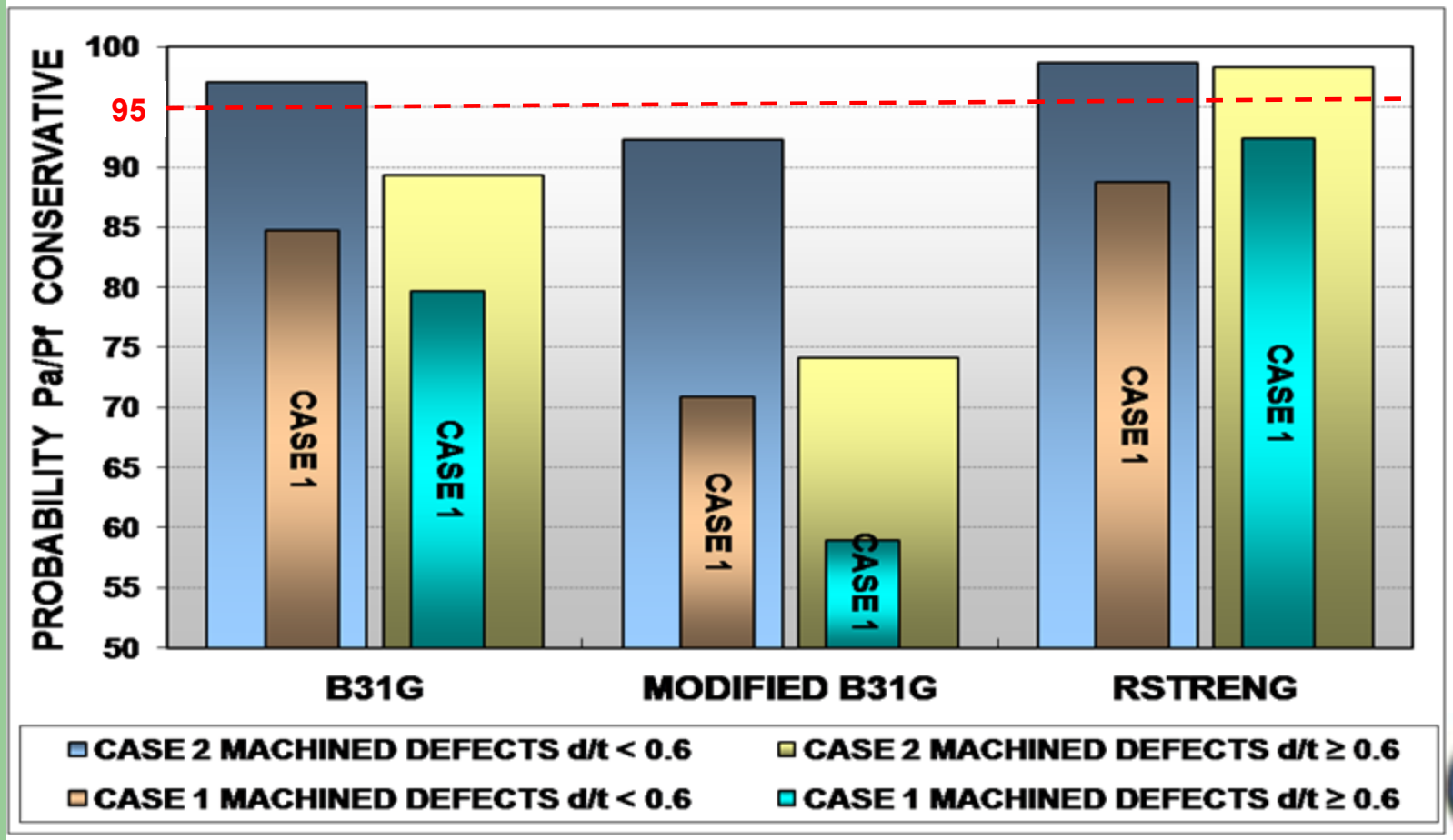
PROBABILITY THAT Pa/Pf IS CONSERVATIVE

REAL DEFECTS BY d/t



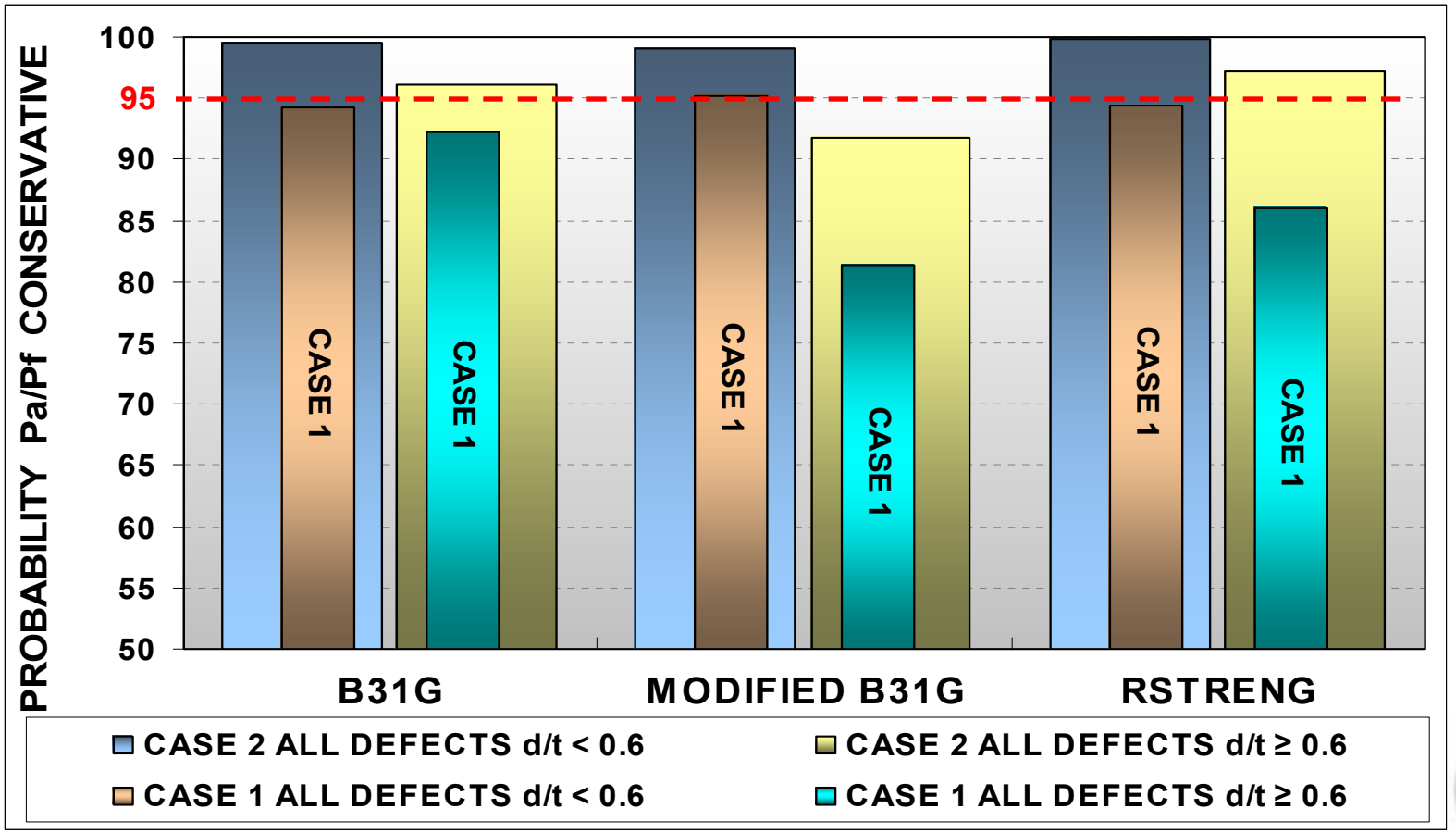
PROBABILITY THAT Pa/Pf IS CONSERVATIVE

MACHINED DEFECTS BY d/t



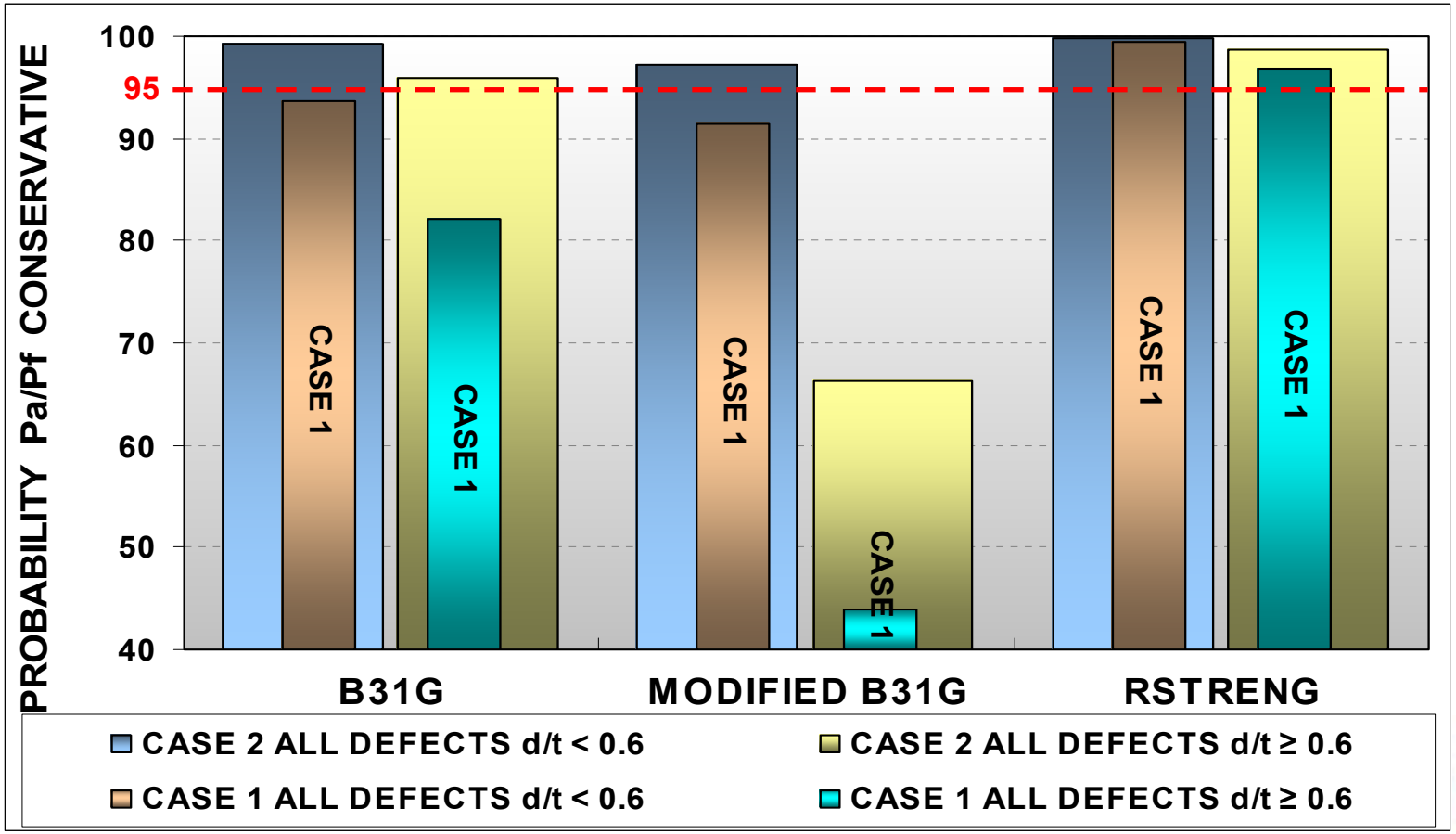
PROBABILITY THAT Pa/Pf IS CONSERVATIVE

PIPEGRADES X52, X55, X56 BY DEFECT DEPTH



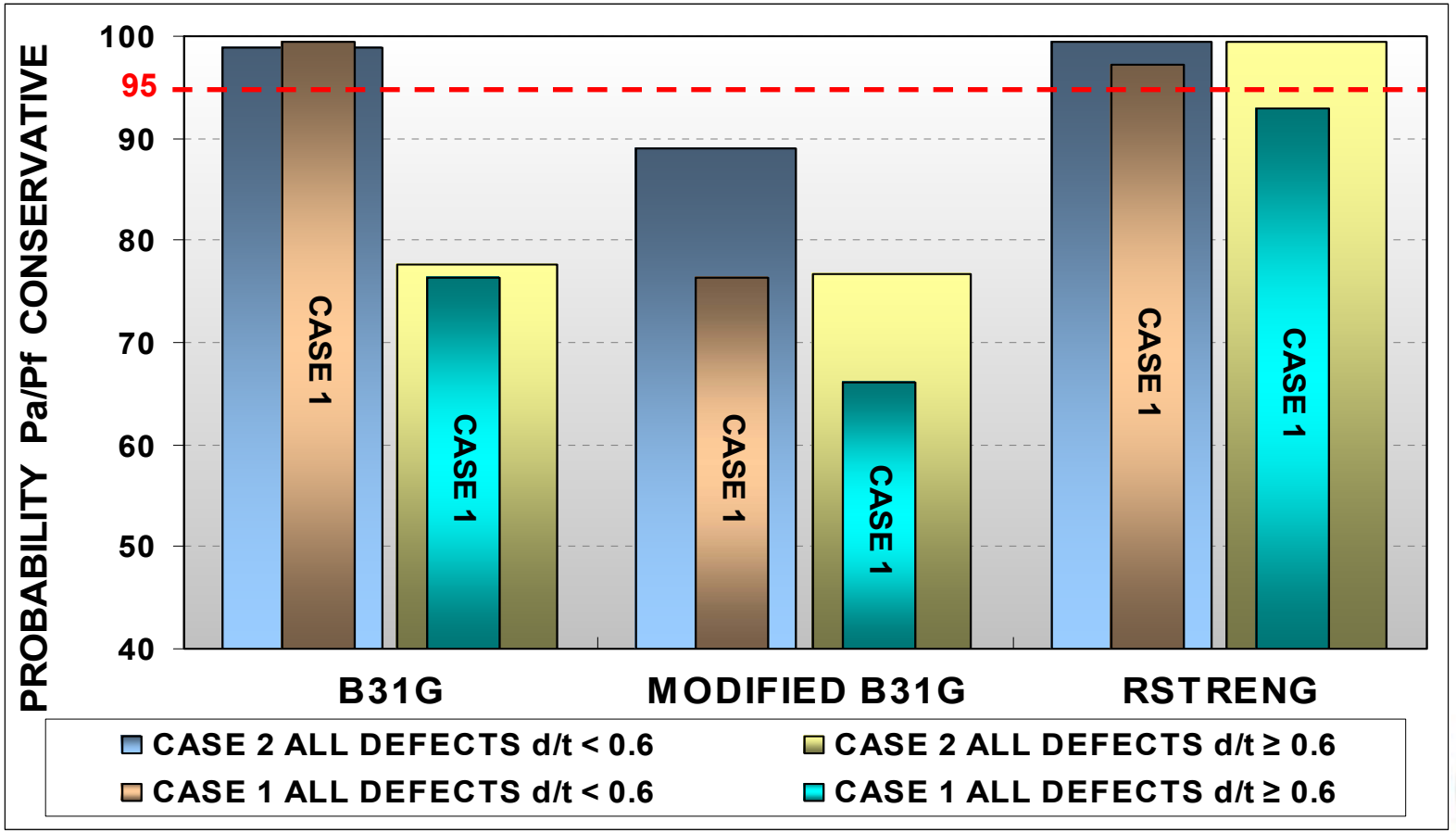
PROBABILITY THAT Pa/Pf IS CONSERVATIVE

PIPEGRADE X60 BY DEFECT DEPTH



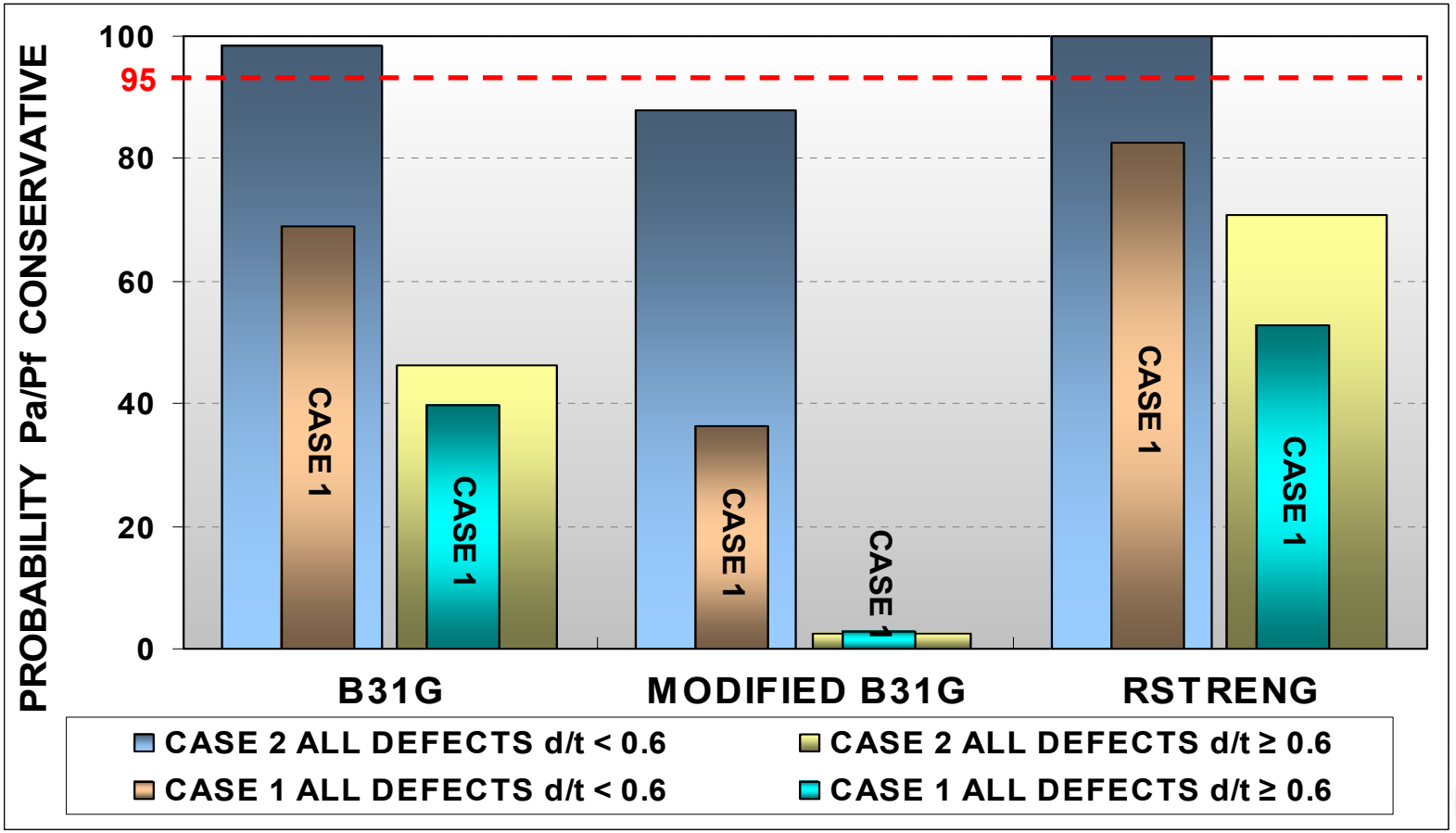
PROBABILITY THAT Pa/Pf IS CONSERVATIVE

PIPEGRADE X65 BY DEFECT DEPTH



PROBABILITY THAT Pa/Pf IS CONSERVATIVE

PIPEGRADES X80, X100 BY DEFECT DEPTH



MACHINED DEFECTS ONLY (NO DATA FOR REAL DEFECTS). ONLY 3 DATA PTS d/t ≥ 0.6

PHMSA EVALUATION
RESULTS

B31G, Modified B31G, and RSTRENG tend to give more frequent non-conservative results when

- Pipe Grade ≥ X60
- d/t ≥ 0.6

PHMSA EVALUATION

RESULTS

METHODS TO CALCULATE CONSERVATIVE Pf WITH CONFIDENCE LEVEL ~ 95%

	X52/X55/X56	X60	X65	X80/X100
d/t < 0.6	B31G^ MOD B31G^ RSTRENG^	B31G* MOD B31G* RSTRENG^	B31G* RSTRENG*	B31G* RSTRENG*
d/t ≥ 0.6	B31G* MOD B31G^ RSTRENG*	B31G* RSTRENG^	RSTRENG^	Incon- clusive

^Based on Both Case 1 and 2 Results *Based on Case 2 Results Only

INDUSTRY PERSPECTIVE

Terry Boss, INGAA

INTERNATIONAL PERSPECTIVE

Rafael Mora
NEB of Canada

BREAK

ILI TOOL TOLERANCE

Consideration of Sizing Accuracy in Making Excavation and Repair Decisions

Chris Hoidal, PHMSA
Moderator

ILI TOOL TOLERANCE PANEL DISCUSSION

- Panel
  - Chris Hoidal, PHMSA Western Region Director (Moderator)
  - Chris McLaren, PHMSA Southwest Region
  - Stephen Westwood (BJ Technologies)
  - Mark Stephens (CFER)
  - Sergio Limon-Tapia (Williams)
  - Chris Whitney (El Paso)

IMPACT OF UNDER-CALLED DEFECT DIMENSIONS

- Accuracy of Pf depends on accuracy of predicted defect dimensions
- Typical MFL ILI tool sizing accuracy specifications (80 - 90% Confidence)
  - Depth: ± 10% t
  - Length: ± 0.8 in

ILI TOOL TOLERANCE PANEL DISCUSSION

- Panel to discuss prudent approaches to take sizing accuracy into account when making integrity-related decisions in response to ILI
- Techniques for considering sizing accuracy

ILI TOOL TOLERANCE PANEL DISCUSSION

- Identify Circumstances Where Sizing Accuracy Most Critical
- Dealing with Over-called Defect Sizes and Unnecessary Digs

ILI TOOL TOLERANCE PANEL DISCUSSION

- Discuss Practical Approaches
  - Add Tool Accuracy Spec to As-Called Defect Size
  - Comparison w/ As-found (Unity plots)
  - Statistical Approaches Such as Probability of Exceedance (POE)
  - Confirmation Digs
  - Comparison with Previous ILI Data

ILI TOOL TOLERANCE

Panel Discussion

Consideration of Sizing Accuracy in Making Excavation and Repair Decisions

Chris McLaren, PHMSA, SW Region

ILI TOOL TOLERANCE Considerations

- ILI Contracts Should Address Tool Specifications
  - Likelihood of Detection
  - Sizing Accuracy
    - Length
    - Depth
    - Width
  - “River Bottom” Profile if RSTRENG Used for Pf

ILI TOOL TOLERANCE Considerations

- Integrate Information and Data
  - Tool Sizing Accuracy Used in Conjunction with Other Sources of Error or Uncertainty
  - Assimilate and consider all known metadata when making excavation/repair decisions
  - Analyze Correlation Between Length and Depth Sizing Accuracy

ILI TOOL TOLERANCE Considerations

- Sizing Accuracy Most Critical for Anomalies at or Near “Immediate” Criteria
- Assure All Actionable Defects Are Promptly Acted Upon
- To Assure Pipeline Integrity, Operators Must Account for Defect Sizing Accuracy
  - Defects Called Near 80% wt May Actually Be >80%
  - FPR Near MAOP May Actually Be Less Than MAOP

ILI TOOL TOLERANCE Considerations

- Critique Tool Performance
- Adjust Integrity Decision Criteria Based on Verified Tool Performance
  - Confirmation Digs
  - Unity Plots
  - POE Analysis

ILI TOOL TOLERANCE PANEL DISCUSSION

Individual Panelist Presentations

ANOMALY REPAIRS
TIME DEPENDENT THREATS – CORROSION

Panel Q&A

LUNCH

CORROSION GROWTH RATES

Panel Discussion

Consideration of Corrosion Growth in Making Excavation and Repair Decisions

Byron Coy, PHMSA

Moderator

CORROSION GROWTH RATES PANEL DISCUSSION

- Panel
  - Byron Coy, PHMSA Eastern Region Director (Moderator)
  - Joe Mataich – PHMSA Southern Region
  - Oliver Moghissi - CC Technologies
  - Drew Hevle - El Paso
  - Kevin Spencer - GE PII
  - Shahani Kariyawasam – TransCanada

CORROSION GROWTH RATES KEY TOPICS

- Calculating projected (future) defect length, width & depth (i.e., predicted size of defect at next planned assessment or at future time of scheduled repair)
- Selection of appropriate assumed corrosion growth rate when the actual corrosion growth rate is not known or cannot be reliably determined

CORROSION GROWTH RATES KEY TOPICS (cont.)

- Determine inspection intervals
- Handling MIC and stray current / interference
- Influence of corrosion rates on available safety margin
- Handling time between as-found and repairs of CP systems (i.e., subtract time from inspection interval)

CORROSION GROWTH RATES

Usage of Standards and Growth Rate Determination

NACE

ASME B31.8S

Other Standards

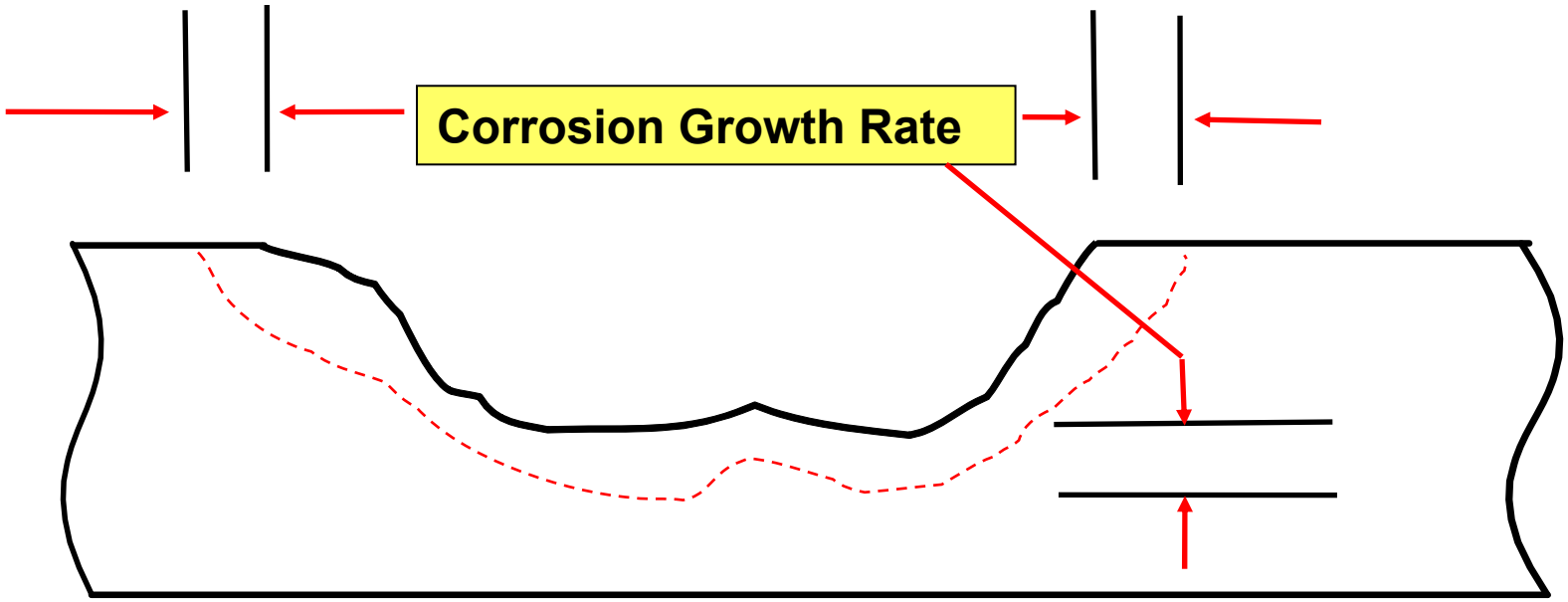
Joe Mataich

PHMSA, Southern Region

FUTURE GROWTH RATE OF ANOMALY

- Calculate defect length, width & depth
- Determine inspection intervals
- Handling MIC and stray current / interference
- Safety factors of corrosion rates
- Handling time between as-found and repairs of CP systems (i.e., subtract time from inspection interval)

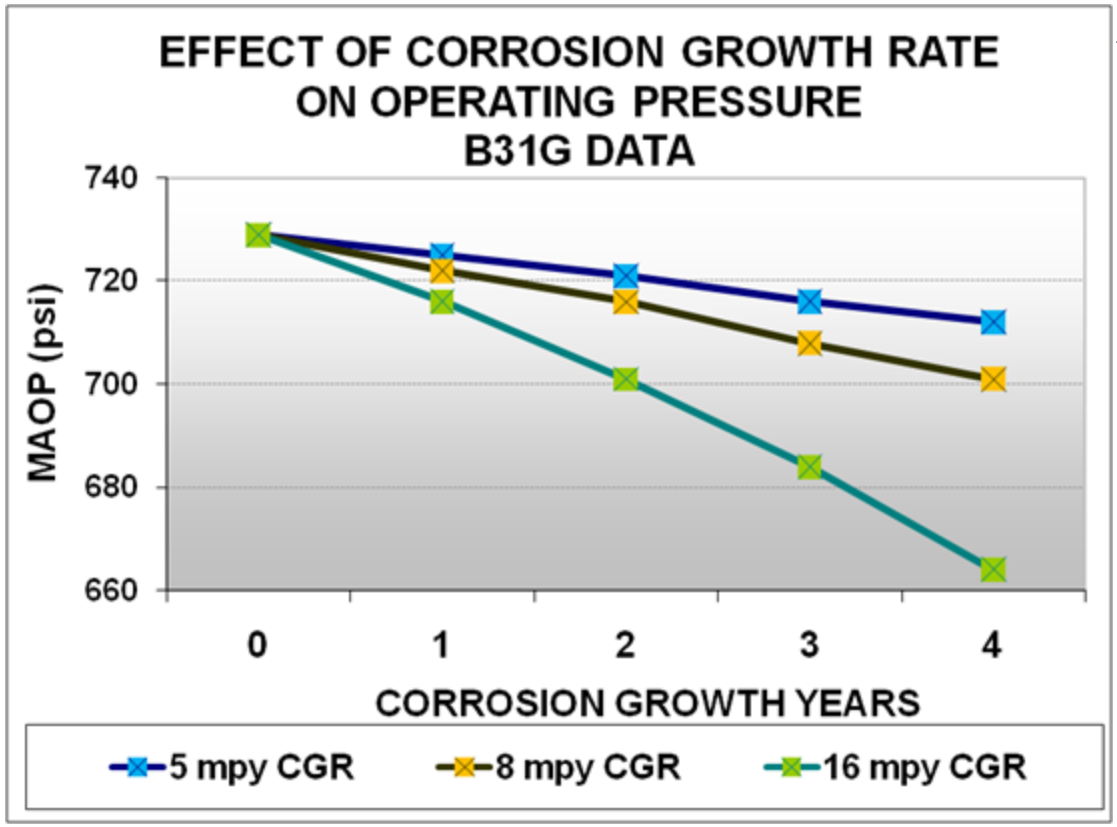
ANOMALY REPAIRS
TIME DEPENDENT THREATS – CORROSION



ANOMALY REPAIRS

TIME DEPENDENT THREATS – CORROSION

IMPORTANCE OF CGR TO REPAIR



Year 0

- 30” x 0.25” x X60 pipe
- 72% SMYS
- MAOP = 720 psi
- Initial wall loss
  0.13” x 2” length

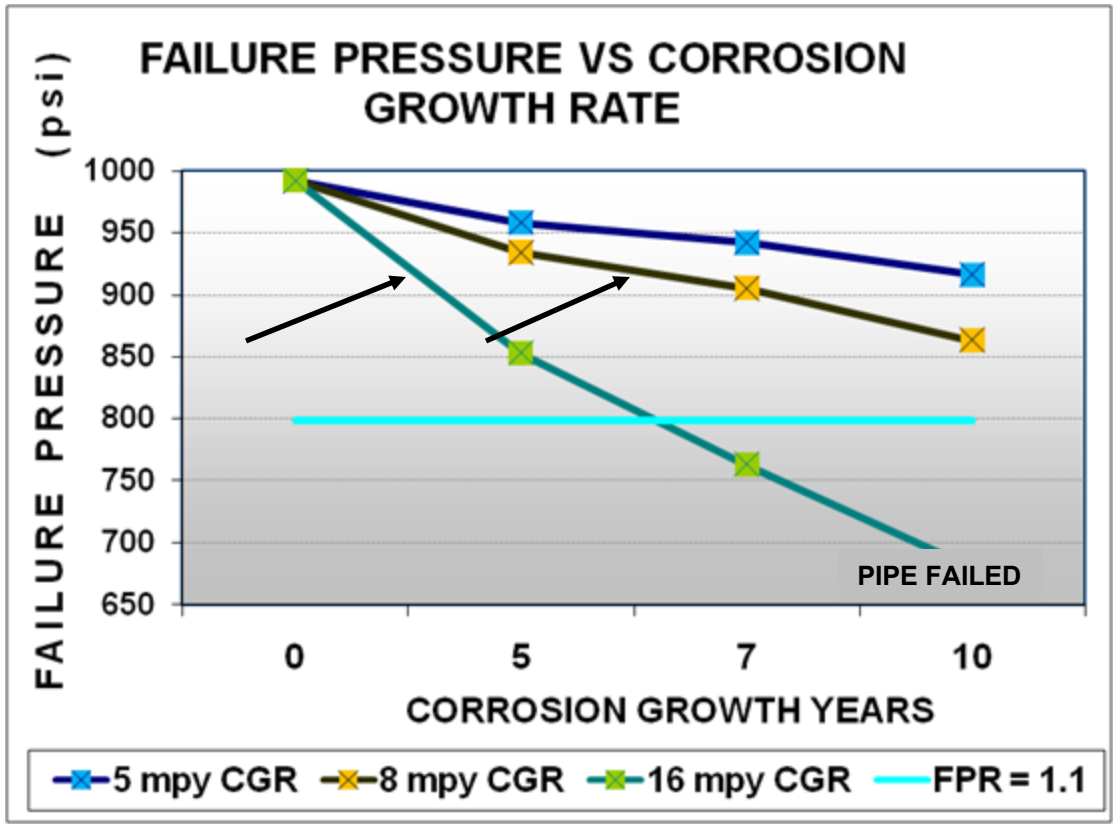
Year 4

- CGR = 16 mpy
- 78% wall loss
  0.194” x 2.128”

ANOMALY REPAIRS

TIME DEPENDENT THREATS – CORROSION

IMPORTANCE OF CGR TO REPAIR DECISIONS

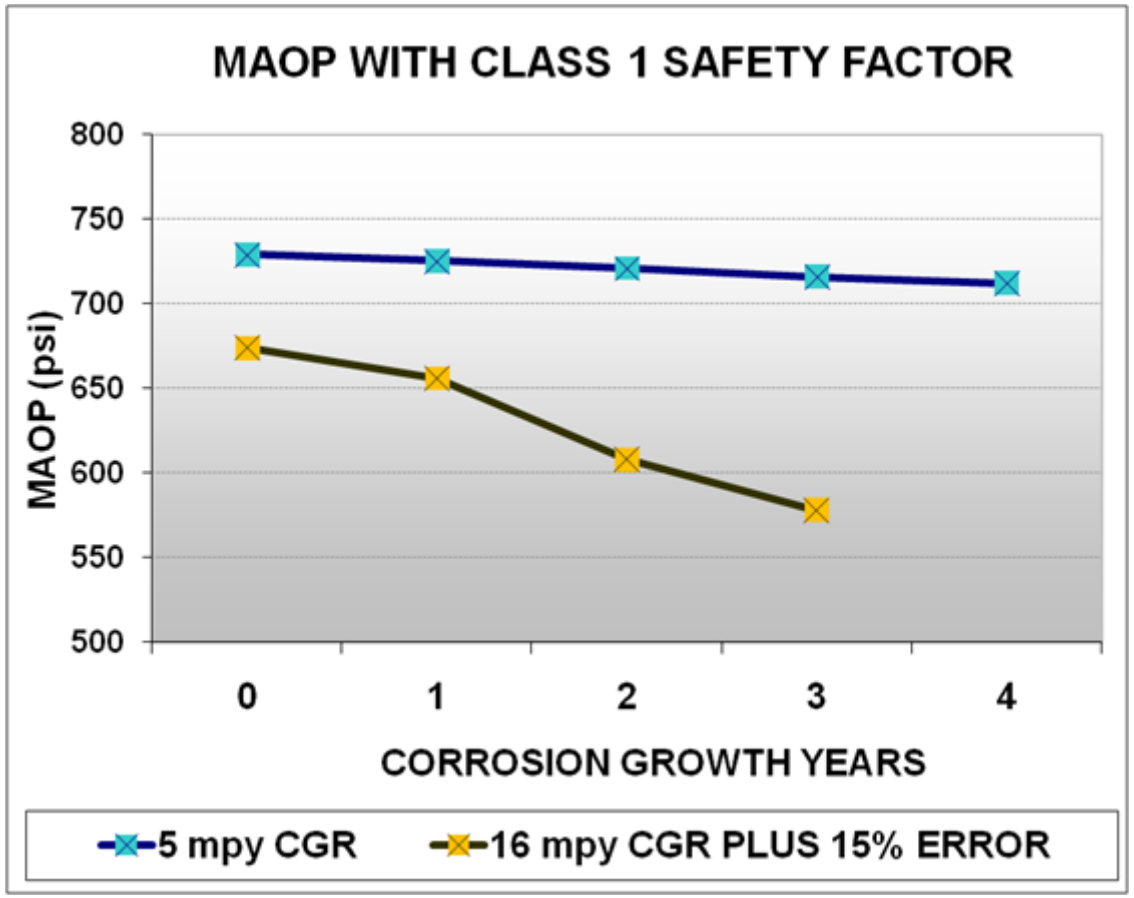


No class location safety factor

80% wall loss

- **In 6 years for CGR 8 mpy**
- **In 3 years for CGR 16 mpy**

ANOMALY REPAIRS
TIME DEPENDENT THREATS – CORROSION



Class location safety factor used

80% wall loss

- **2 years for 16 mpy and 5 mpy**
- **Depth and length under estimated by 15%**

MAOP change in 4 years

ANOMALY REPAIRS
TIME DEPENDENT THREATS – CORROSION

Summary

- Corrosion Growth Rates may exacerbate problems with non-conservative remaining strength calculations
- Tool tolerances may exacerbate problems with non-conservative remaining strength calculations
- Outside Stresses

CORROSION GROWTH RATES KEY TOPICS (cont.)

Individual Panelist Presentations

ANOMALY REPAIRS
TIME DEPENDENT THREATS – CORROSION

Panel Q&A

BREAK

ANOMALY EVALUATION AND REPAIR

Evaluation Methods Available for Use with ILI Results

Application of Safety Factors in Making Excavation and Repair Decisions

Rod Seeley, PHMSA

Moderator

ANOMALY EVALUATION & REPAIR: Panel Discussion

Panel

- Rod Seeley, SW Region Director (Moderator)
- Zach Barrett (PHMSA Director, State Programs)
- Keith Leewis (Leewis and Associates)
- John Kiefner (Kiefner and Associates)
- Chia-pin Hsiao (Chevron)
- Dave Johnson (Panhandle)

ANOMALY EVALUATION & REPAIR: Panel Discussion

- What safety factors should be used in evaluating ILI results?
  - HCA
  - Non-HCA
  - Pipe operated under special permit
  - Class location change pipeline
- Discuss prudent and safety focused criteria for investigating anomalies and repairing defects in non-HCA areas (no special permit)

ANOMALY EVALUATION & REPAIR: Panel Discussion

- Discuss how the following considerations should be applied to provide adequate safety margins?
  - Tool tolerance
  - Corrosion growth rate
  - External stresses
  - Overpressure protection

ANOMALY EVALUATION AND REPAIR

Evaluation Methods Available for Use with ILI Results

Application of Safety Factors in Making Excavation and Repair Decisions

Zach Barrett

ANOMALY EVALUATION AND REPAIR
SAFETY FACTORS

- Regulatory Requirements
  - 192.485 and192.713
    "…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., Psafe>MAOP)
  - Psafe (also called P' in B31G) includes appropriate design/safety factor (F) : Psafe=Pf/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 Psafe (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)

			Immediate		1 Year		Monitored	
Location	Class Location	%SMYS	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

ANOMALY EVALUATION AND REPAIR

PROPOSED NON-HCA REPAIR CRITERIA

Panel Q&A

CLOSING

Alan Mayberry
PHMSA Director of Engineering & Emergency Support

October 22, 2008