# Evolution of Life Cycle Management - Natural Gas Piping Code

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# Where Have We Come From?

- ASME B31.8 embodied life cycle view in 1950’s Code

  **Design – Materials – Construction – Operation – Maintenance**
- Technology of the time established relationships to manage threats
  - Explicitly relied on Stress-Based Design – single track
  - Examples – D/t, corrosion tolerances, etc.
- Code developers recognized limitations of technology and imprecise tools (Emeritus Report, GRI-98/0367.1)
- Addressed “limitations” by embedding conservative safety factors
- Graduated safety factors to provide additional protection as consequences increased

# What Happened?

- Technology advanced … incrementally
  - Better steel, more durable coatings, improved quality control in manufacturing, improved construction practices, new inspection tools
- Led to incremental changes
  - Improved performance against specific threats/issues
  - Unintended collateral affects occurred that were not well-addressed by original Stress-Based model
    - Examples – D/t, corrosion tolerances, class vs IMP, etc.
- Implementation
  - Caused changes in practices – discretionary
  - Net result yielded improved performance
  - Not formalized – not an integrated or consistent approach

# What Happened? (Continued)

- Safety performance data shows:
  - Safety performance of international and grandfathered U.S. pipelines at >72% is equivalent or better
  - Stress is not primary determinant in failure frequency
- More rigorous practices more than compensated for less conservative safety factors
- ASME B31.8S captured value of more rigorous analysis in maintenance stage of life cycle
  - Addressed most significant opportunity - assets in the ground
- Recalibrated maintenance stage with 2000 technology via ASME B31.8S
  - More explicit and more rigorous

# Where Are We?

- Many countries provide for operation at 80% SMYS
- Design Basis has become commensurately more complex
  - Wider range of choices
  - Augment Stress-Based w/ Limit State
- Some use prescriptive … some even use probabilistic in the form of Reliability-Based Design (RBD)
- Must recognize the ratio of operators to regulators
  - Europe: 1-3 to 1
  - Canada and Australia: 15-25 to 1
  - United States: 300-400 to 1
  - Higher ratio makes interaction more difficult – different tracks (formats) for different ratios

# Where Is ASME Going?

- Extend work started with B31.8S to the balance of the life cycle
- Create venue to improve performance & mitigate collateral effects especially at elevated stress levels
  - Alternate life cycle approach – front to back
  - Parallel document to existing format - Div. 2
  - Re-establish relationships across life cycle with 2006 technology
  - Increase level of rigor
  - Establish as a “package” not a menu

# Where Is ASME Going? (Continued)

- Establish alternate tracks to provide pre-packaged, diligent cost/value/performance choices
- Existing Code (graduated, big safety factors)
- Div. 2, Updated Life Cycle Model

  (increased rigor, require IMP integration)
  - Prescriptive Limit State w/ conventional stress basis at 80%
  - Prescriptive Limit State w/ advanced modeling
  - Probabilistic RBD

# Conclusions

- Understanding why we do what we do is fundamentally important in order to successfully change
- Incremental change is good … to a point
- Must remain conscious of goal to manage all threats and improve performance
- Can & do perform better at 80%

But … it is not just about design – requires more rigor and greater diligence across the life cycle