MC121
Design by Analysis Requirements in ASME BPV Code, Section VIII, Division 2 – Alternative Rules

Day 1

- Background and Development of Section VIII Division 2
  - Organization of VIII-2
  - Overview Of VIII-2, Parts 1 through 9

- Comparison: VIII-1 vs VIII-2 with a Focus on Cost
  - ASME VIII-1 PLUS Construction, *(It’s what most refinery & petrochemical companies do!)*
  - Comparison – ASME VIII-1 vs ASME VIII-2
  - Comparison – tmin & The VIII-2 Class 2 Allowable Stress Bases
  - Comparison – ASME VIII-1 vs ASME VIII-2 – Summary

- References – ASME PTB-1 & PTB-2

- Basic Concepts in Section VIII, Division 2, Part 5 - Design by Analysis
  - Design-By-Analysis (DBA)
  - The Force Method
  - Stress Definitions
  - Primary Stress & Limits
  - VIII-2 Allowable Stress Basis
  - Secondary Stress & Limits
  - Peak Stress & Limits
  - Stress Classification – The Hopper Diagram
  - Stress Classification – Nozzles
  - Stress Calculations for Code Compliance

- Supplemental Information for VIII-2, Part 5 Design-By-Analysis Applicability
  - Applicability
  - Numerical Analysis
  - Numerical Analysis & Material properties
  - Material Properties

- Protection Against Plastic Collapse
  - Overview
  - Elastic Stress Analysis Method
  - Limit Load Analysis Method
  - Elastic-Plastic (EP) Analysis Method
  - Stress Measure for Multiaxial Stress States
  - Elastic Stress Analysis Method – Example 1
  - Limit Load Analysis Method – Example 1
  - Elastic-Plastic (EP) Analysis Method – Example 1
  - Comparison of Methods – Example 1
  - Example 2
• Protection Against Local Strain
  - Overview
  - Elastic Stress Analysis Method
  - Elastic-Plastic (EP) Analysis Method

Day 2
• Design for the Protection of Buckling
  - The Lecture Covers
  - What is Buckling?
  - Bifurcation or Eigenvalue Analysis
  - Buckling Analysis Options
  - Type 1 Buckling Analysis
  - Design Margin
  - Effects of Imperfections On Buckling Loads
  - Type 2 Buckling Analysis
  - Type 3 Buckling Analysis
  - Load Cases in Buckling Analysis
  - Example
  - References

• Design for the Protection of Fatigue
  - Definition
  - Fatigue Basics
  - VIII-2 Fatigue Analysis – Overview
  - Fatigue Screening
  - Fatigue Assessment Methods
  - Fatigue Assessment Methods – Comparison
  - Fatigue Assessment Methods – Examples
  - Fatigue Assessment Methods – References

• Development Of The ASME Smooth Bar Fatigue Curves
• The Infamous Ke and Kv Factors

Day 3
• Fundamentals of Ratcheting for Design by Analysis
  - Ratcheting Definition
  - Ratcheting Overview
  - Ratcheting Assessment – Elastic Stress Analysis
  - Ratcheting Assessment – Bree Diagram
  - Ratcheting Assessment – Bree Diagram – Loading Conditions
  - Ratcheting Assessment – Bree Diagram – Effect of Yield Stress
  - Ratcheting Overview – Elastic-Plastic Stress Analysis
  - Elastic-Plastic Modeling of Ratcheting Using FEA
  - Cyclic Plasticity
  - Ratcheting Summary
  - References - Ratcheting

• Summary of Section VIII Division 2 Code Case 2605
- Background of ASME VIII-2 Code Case 2605 (CC2605)
- Technical Background of CC2605
- Highlights of CC2605
- Modifications to CC2605
- Example Problem

- What’s New in Fatigue – see API 579-1/ASME FFS-1, Part 14
- Fatigue Analysis Using A Fracture Mechanics Approach
- Material Toughness Requirements Using A Fracture Mechanics Approach
  - Brittle Fracture Overview
  - VIII-2 Toughness Rules
  - Using Fracture Mechanics To Determine the MDMT
  - Technical Basis Of VIII-2 Toughness Rules
  - Summary