Title: ASME B31.3 Process Piping – Design, Construction, and Mechanical Integrity

Potential PDH: 32 **Code:** BTT011

Description:

The course will review the basic requirements of the ASME B31 Code for Pressure Piping with emphasis on B31.3, Process Piping. General topics in the course include Code organization and intent, pressure design, design for sustained loads including support design, flexibility analysis, equipment loads, flanges, expansion joints, supports and restraints, materials, fabrication, examination, testing, and, for existing piping systems, mechanical integrity. Applications of these concepts, including simple hand analysis methods and computer-based analysis methods, will be demonstrated. Included will be comparisons between ASME B31.3 and ASME B31.1, Power Piping. Inspection and maintenance (mechanical integrity) of existing piping systems will be covered, as provided in API 570, Piping Inspection Code.

Each session will be conducted in a lecture/discussion/problem solving format designed to provide intensive instruction and guidance on understanding Code requirements. The instructors will be available following each day's session to provide participants with further opportunity for discussion and consideration of specific problems.

Outline:

1. Introduction
   - General Definitions
   - Piping Development Process
   - B31 Piping Codes
   - The ASME B31.3 Code
   - Fluid Service Definitions
2. Metallic Pipe & Fitting Selection
   - Piping System Failure
   - Bases for Selection
   - Listed versus Unlisted Piping Components
   - Fluid Service Requirements
   - Piping components
3. Materials
   - Strength of Materials
   - Bases for Design Stresses
   - B31.3 Material Requirements
   - Deterioration in Service
4. Pressure Design (metallic)
   - Design Pressure & Temperature
   - Quality & Weld Joint Strength Factors
   - Pressure Design of Components
   - Piping Material Specifications
5. Valve Selection
   - Code Requirements
   - Selection by Valve Type

6. Introduction to Flexibility Analysis
   - What are we trying to achieve?
   - Sustained loads
   - Displacement Loads
   - Reaction Design Criteria
   - Stress Intensification
   - Flexibility Analysis Example
7. Layout and Support
   - General Considerations
   - Support Spacing
   - Support Locations
   - Support Elements
   - The Sustained Load Analysis
   - Fixing Problems
8. Flexibility
   - General Considerations
   - Friction
   - Elbow Flexibility
   - Thermal Expansion
   - Spring Hangers
   - The Displacement Load Analysis
   - High Cycle Fatigue
   - Elastic follow-up
   - Fixing Problems
9. Reactions
   - General Considerations
   - Fabricated Equipment
   - Rotating Equipment
   - Supports
   - Flanged Joints
   - Cold Spring
10. Flexibility Analysis Methods
    - When to Perform a Detailed Analysis
    - Considerations
    - Solving Problems
11. Designing with Expansion Joints
    - Types of Expansion Joints
    - Pressure Thrust
    - Installation of Expansion Joints
    - Metal Bellows Expansion Joints
    - Other considerations
12. Fabrication and Installation
    - Welder/Brazer Qualification
    - Welding Processes
    - Weld Preparation
    - Typical Welds
    - Preheating & Heat Treatment
    - Bending & Forming
    - Typical Owner Added Requirements

- Installation
- Flange Joints

13. Inspection, Examination and Testing
    - Inspection
    - Examination
    - Leak Testing
14. Systems
    - Instrument Piping
    - Pressure Relieving Systems
15. Nonmetallic Piping Systems
    - General
    - Thermoplastics
    - Reinforced thermosetting resins
    - Concrete and glass
    - Piping lined with nonmetals
    - Limitations
16. Category M Fluid Service
    - General
    - Design
    - Fabrication
    - Examination and Testing
    - Typical Owner Added Requirements
17. High Pressure Piping
    - General
    - Materials
    - Pressure Design
    - 7Limitations
    - Flexibility Analysis
    - Fabrication
    - Examination and Testing
    - Overpressure Protection
18. High Purity Piping
    - General
    - Fabrication and Installation
    - Examination and Testing
    - Category M Fluid Service
19. In-service Piping - Inspection, Repair, Alteration and Rerating
    - API 570 Piping Inspection Code
    - What to Inspect
    - Types of Inspection
    - Inspection Practices
    - Frequency and Extent of Inspection
    - Remaining Life Calculation
    - Repairs and Alterations
    - Rerating
20. Introduction to Piping Vibration
    - Single Degree of Freedom System
    - Damping
    - Screening Criteria

- Determining the Cause
- Solving the Problem

21. What's Different in B31.1
    - Scopes
    - Organization of the Codes
    - Bases for Allowable Stresses
    - Piping Component Standards
    - Fluid Service Requirements
    - Material Requirements
    - Pressure Design and Flexibility Analysis
    - Fabrication and Installation
    - Inspection, Examination and Testing
22. Underground Piping
    - Steel Piping
    - Ductile Iron Piping
    - Nonmetallic Piping
23. Final Exam
    - Discussion Questions

Instructor:

Don Frikken is an internationally recognized authority in piping design. Now employed by Becht Engineering, Don had been with Solutia, Inc. and Monsanto Company for 34 years; working on a wide range of activities including piping and mechanical design, project engineering, and engineering standards. Don's principal specialty is piping design, including design of complex piping systems, piping flexibility analysis, selection of piping components including valves, development of piping standards and specifications, and developing and teaching numerous piping seminars and workshops.

He is an ASME Fellow and is active on various ASME standards committees. He is a member and past Chair of the ASME B31.3 Process Piping Code committee, a member and past Chair of the B31 Standards Committee, which oversees all B31 Piping Code committees, a member of the B16 Standards Committee, a past member of the ASME Board of Governors, and a past member of the Council on Standards and Certification, which oversees ASME's codes and standards development.

Don has received many awards, including the ASME Melvin R. Green Codes and Standards Medal, which recognizes outstanding contributions to the development of documents used in ASME programs of technical codification, standardization and certification; the ASME B31 Forever Medal for Excellence in Piping; and the ASME B16 Hall of Fame Medal. Don graduated with a bachelor's degree in mechanical engineering from Kansas State University and has a master's degree in civil engineering from the University of Missouri-Rolla.