MC111
Piping Vibration Causes and Remedies – a Practical Approach

Days 1 & 2

- Introduction
  - General Definitions
  - What We are Trying to Prevent
  - Vibration Types
  - When to Solve Problems

- Mechanical Vibration
  - Single Degree of Freedom System
  - Displacement, Velocity and Acceleration
  - Damping
  - Multiple Degrees of Freedom
  - Simplified Vibration Analysis
  - What to do with Calculated Stress
  - Screening Criteria

- Acoustic Resonance
  - What is it?
  - System Effects
  - EI Guidelines
  - API 618
  - Fixing Problems
  - Example

- Reciprocating Pumps
  - General
  - Pump Discharge
  - Pump Suction
  - Fixing Problems
  - Example

- Surge
  - What is it?
  - Surge Pressure
  - Surge Wave Velocity
  - Slow Closing Valve
  - Thrust Forces
  - Vapor Column Collapse
  - Solutions to Problems
  - Examples

- Slug Flow
  - General
  - Slug Flow Force
  - Examples
  - Corrective Measures
• High Frequency Vibration
  - General
  - Acoustic Resonance
  - Acoustic Fatigue
  - Vortex Shedding

• Earthquake
  - General
  - Earthquake experience
  - Analysis

• Other Sources of Vibration
  - High flow velocity
  - Cavitation
  - Flashing
  - Flow turbulence
  - Non-condensable gases
  - Wind
  - Pressure relief valves
  - Expansion Joints
  - Mechanical Excitation

• More Rigorous Analyses
  - OM-3 Requirements
  - Types of Computer Analyses

• Solving Problems During Design
  - EI Vibration Guidelines
  - Other Guidance

• Solutions to Vibration Problems
  - Piping Restraints
  - EI Guidelines - corrective actions
  - Severe Cyclic Conditions

• Practical Examples
  - Essential Service Water
  - Cumene Piping
  - Steam & Feed Water Piping
  - Cogen Plant Cooling Water
  - Furnace Outlet Line
  - Thick Stock Pump
  - Process Condensate

• Summary & Wrap-up