

## AS-BUILT PIPING ANALYSIS

Computer Based Training Module Available on NANTeL



### ABSTRACT

This CBT is a self-paced, detailed, comprehensive, nuclear industry generic overview of the generic design and licensing basis for understanding as-built piping analysis. The course addresses key regulatory requirements, the key inputs to analysis (pipe, supports, (fixed, thermal and other loads) and considerations for engineering evaluation and response to industry and regulatory guidance.



### INTENDED AUDIENCE

1. Experienced nuclear plant mechanical and structural engineers who are developing expertise in As-Built Piping Analysis
2. Site engineering Managers or Supervisors



### DURATION

- 3.5 hours
- An additional 8-12 hours for reading materials provided within the CBT

## TERMINAL LEARNING OBJECTIVES

1. Identify which Codes apply to the analysis and qualification of piping systems, steel support structures and attachments to concrete, and where to find the station-specific applicable Codes.
2. Identify the key design input documents.
3. Identify responsibility for piping classification and boundaries of jurisdiction.
4. Identify which SRP sections and which RG apply to the analysis and qualification of piping systems.
5. Identify which IE Bulletins addressed as-built reconciliation.
6. List the steps involved in a piping analysis process, including as-built.
7. Identify the input required to model a piping system for analysis.
8. Identify the failure modes addressed by the Code piping analysis equations.
9. Identify the common types of pipe supports and their use.
10. State the common criteria used for decoupling branch lines for headers in modeling.
11. Identify the key parameters in modeling equipment nozzles for a piping analysis.
12. State the sustained loads applicable to piping analysis and qualification.
13. Explain the terms used in the ASME B31 and ASME III equation for minimum wall thickness.
14. Explain the terms used in the ASME B31 and ASME III longitudinal stress equation for sustained loads.
15. State the allowable longitudinal stress for sustained loads.
16. Describe the occasional loads and load combinations applicable to piping analysis and qualification.
17. State the key steps in planning an as-built walk-down, identify prerequisites and interfaces.
18. Identify differences between an as-built walk-down and a walk-down after a transient event.
19. State which industry documents address as-built tolerances for piping and for pipe supports.
20. Given a piping as-built deviation, state under what conditions it would be acceptable.
21. Describe the difference in pipe stress equations between ASME B31.1 and ASME III.
22. State where to find the applicable piping qualification stress equations for your station.
23. State how your plant determines if Class 1 piping complies with fatigue analysis commitments of the FSAR.

## KEY INDUSTRY DOCUMENTS

1. API000 DCD Sect 3.7-Seismic
2. ASME III Appendix B- Owners Design Specifications
3. ASME III Appendix C-Certificant Holders Design Report
4. ASME III Appendix NF-D Tolerances
5. ASME III Appendix T Recommended Tolerances for Reconciliation of Piping Systems
6. ASME III B.31.1-2014 Section 104 Pressure Design of Components VS NC-3641.1
7. ASME III B.31.1-2014 Section 137.4.5 Hydro
8. ASME III OM3
9. ASME III Table TE-1 Thermal Expansion for Ferrous Materials
10. ASME NCA-2142.4
11. ASME NCA-3250 - NCA-3260
12. ASME NF-1132
13. EPRI 1009704 Sect 5.3.1.1-CTs and VTs
14. EPRI Technical Report-Water Hammer Prevention Mitigation and Accommodation
15. EPRI TR-1001017 Section 2.1 Thermal Stratification
16. MSS-SP-58 Table 1 Minimum Design Load Ratings
17. NRC 10 CFR 50 Appendix S-Earthquake Engineering Criteria for Nuclear Power Plants
18. NRC Bulletin 79-4 Seismic Analysis for As-Built Safety-Related Piping Systems
19. NUREG-800 BTP 8-6 Adequacy of Station Elec Distribution System Voltages
20. NUREG-800 SRP 3.5.3 N-690 Overall Damage Prediction
21. NUREG-800 SRP 3.7.2 Seismic System Analysis
22. NUREG-800 SRP 3.9.2 Dynamic Testing and Analysis of SSBs
23. NUREG-800 SRP 3.12 ASME Code Class 1-2-3 PIPING SYSTEMS
24. NUREG-800 SRP Section 3.6.3 GDC4 Acceptance Criteria
25. RG 1.26 Quality Group Classifications and Standards
26. RG 1.29 Seismic Design Classification
27. RG 1.61 Damping Values for Seismic Design of Nuclear Power Plants