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Fitness for Service - API 579-1/ASME FFS-1 2007

8 - 26 July 2024

Geneva (Switzerland)

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course code: E6030 From: 8 - 26 July 2024 Venue: Geneva (Switzerland) - course Fees: 6750 Euro

INTRODUCTION

A plant objective is to attain the maximum economic benefit and service life from existing equipment without sacrificing integrity. This requires accurate assessment of the condition of the equipment and their suitability for the actual service. Fitness-For-Service (FFS) assessments are quantitative engineering evaluations that are performed to demonstrate the structural integrity of an in-service pressure equipment/component containing a flaw or damage. In June 2007 API and ASME produced a joint update of each society's version of FITNESS FOR SERVICE. The new standard is now called API 579-1/ASME FFS-1 2007 Fitness-For-Service. It has become the defacto international standard for conducting FFS assessments. The main deliverables from FFS assessments are improved plant integrity and reduced maintenance costs.

The participant in this integrated and comprehensive course will learn to apply the rules of the API/ASME 579 standard "Fitness-for-Service" to evaluate the integrity and remaining life of pressure vessels, storage tanks, piping systems and pipelines, to make cost effective run-repair-replace decisions, and select the appropriate repair options. In this programme you will learn:

- Fundamental principles of fitness-for-service, their practical application through case histories, and a step-by-step evaluation process for each type of degradation mechanism
- Basic design of pressure vessels, piping and storage tanks, fundamental principles of component integrity, application of the ASME code rules, material properties of strength and toughness, and the introduction to stress and fracture mechanics
- A review of degradation mechanisms and the application of API/ASME 579 to brittle fracture, general metal loss, local wall thinning, pitting, blisters and laminations, mechanical defects (dents, gouges, misalignment, and distortion), crack-like flaws (stress corrosion cracking, weld flaws, crack-like defects), fatigue, HIC & SOHIC and fire damage

PRE-REQUISITE

This is an intensive and comprehensive course in which participants are drawn into active participation in discussions and example solutions to enhance learning. Delegates should be familiar with pressurized equipment and piping systems and will probably have a technical degree and should be conversant in calculations using a scientific calculator. Delegates may bring with them a hard copy of **API 579-1/ASME FFS-1 2007** (although this is not essential). A scientific calculator will be provided.

PROGRAMME OBJECTIVES

- Latest techniques to determine the fitness-for-service of operating tanks, vessels, piping systems and pipelines; and make cost-effective run-repair-replace decisions based on the principles of API recommended practice 579 "Fitness-for-Service"
- Balanced approach between the fundamental technical principles of structural integrity, stress and fracture analysis, and their practical application to field conditions
- Provides the participants with the tools necessary to recognize and assess defects in pressure vessels, storage tanks and piping
- Presents and applies the fundamentals rules of the ASME code to operating equipment and

systems
- Introduces the participants to the practical application of the ASME and API rules for structural integrity of static equipment and pipelines, and their use to assess remaining life
- Applies API/ASME 579 "Fitness-for-Service" through practical examples to analyze degraded conditions and make cost-effective repair or use-as-is decisions
- Applies the step-by-step 3-level approach of API/ASME 579 to evaluate inspection results and recognize potential failure modes
- Technical basis for reliability-based (risk-based) evaluation of remaining life
- Latest developments in defect assessment techniques, starting with simple rules (level 1) and progressing to the more comprehensive evaluation techniques (level 3)
- Participants will be able to evaluate the structural integrity of corroded or damaged equipment, and assess their remaining life. Degradation mechanisms include: brittle fracture, general metal loss, local wall thinning, pitting, blisters and laminations, mechanical defects (dents, gouges, misalignment, and distortion), crack-like flaws (stress corrosion cracking, weld flaws, crack-like defects), fatigue, and fire damage

ORGANISATIONAL IMPACT

- Take full advantage of the best industry practice of API/ASME 579 standard "Fitness-for-Service" to avoid unnecessary shutdowns, replacements or repairs
- Make cost-effective run-or-repair decisions for equipment in-service
- Plan, repair or replace projects, where necessary, based on the timely fitness-for-service prediction of remaining life of tanks, vessels, piping and pipelines

PERSONAL IMPACT

- Opportunity to extend his/her expertise in equipment design, defect assessment, and equipment integrity analysis
- Equipped with the necessary step-by-step procedure, formulas, and examples to perform simple (level 1), and intermediate (level 2) quantitative evaluations of a degraded condition and make technically sound and cost-effective run-or-repair decisions
- The delegates will receive comprehensive programme notes that supplement the FFS standard, including copies of all presentations slides and worked examples to use as a reference
- Introduced to the latest developments in fitness-for-service rules and their application, as well as a view of the future directions and developments in this important field

PROGRAMME OUTLINE

Foundations of Fitness-For-Service Assessment

- Introduction
    - Overview of the American Petroleum Institute (API) codes and standards
    - Overview of the American Society of Mechanical Engineers codes and standards with historical background
- Fitness For Service
- Overview of API 579 contents, objectives and applications
- How to apply API 579 for cost-effective run-or-repair decisions
- Fitness-for-Service assessment procedure
- An overview of what is new in the latest release
- List of Parts and Annexes and examples of major Parts
- PART 1 - Introduction
- PART 2 - Fitness-For-Service Engineering Assessment Procedure

- Structure and Contents of the FFS Standard

Mechanical Integrity and Fitness for Service

- Overview of Mechanical Integrity of pressure equipment & piping system
- ANNEX A - Thickness, MAWP & Stress Equations for a FFS Assessment
    - Calculation of tmin, MAWP (MFH) & Membrane Stress
    - Pressure Vessel & End Caps
    - Piping components & Boiler Tubes
- ANNEX G - Damage Mechanisms
- NDE techniques
- PT, VT, MT, ET, UT, RT
- Overview of Brittle Fracture Mechanism
- Data Requirements
- Assessment Techniques
- Acceptance Criteria
- PART 3 - Assessment of Existing Equipment for Brittle Fracture

Metal Loss - Corrosion and Pitting

- PART 4 - Assessment of General Metal Loss
    - Overview of Corrosion Mechanisms
    - Data Requirements
    - Assessment Techniques
    - Acceptance Criteria
    - Worked example
- PART 5 - Assessment of Local Metal Loss
- Overview of Local Metal Loss Mechanisms
- Data Requirements
- Assessment Techniques
- Acceptance Criteria
- Worked example
- Overview of Pitting Corrosion Mechanisms
- Data Requirements
- Assessment Techniques
- Acceptance Criteria
- Worked example
- PART 6 - Assessment of Pitting Corrosion

Blisters and Local Damage

- PART 7 - Hydrogen Blisters, HIC & SOHIC
    - Overview of Hydrogen Damage
    - Data Requirements
    - Assessment Techniques
    - Acceptance Criteria
- PART 8 - Weld Misalignment & Shell Distortions
- Overview of Weld Misalignment & Shell Distortions
- Data Requirements
- Assessment Techniques
- Acceptance Criteria
- Worked example
- Overview of Fracture Mechanics

- Elements of RSTRENG
- Data Requirements
- Assessment Techniques
- Acceptance Criteria
- Worked example
- PART 9 - Assessment of Crack-Like Flaws

Creep, Fire and Mechanical Damage

- PART 10 - Assessment of Components Operating in the Creep Range
    - Overview of Creep Damage Mechanisms
    - Data Requirements
    - Assessment Techniques
    - Acceptance Criteria
    - Worked example
- PART 11 - Assessment of Fire Damage
- Overview of Fire Damage
- Data Requirements
- Assessment Techniques
- Acceptance Criteria
- Case study – Example of fire damage assessment
- Overview of Mechanical Damage
- Various software packages considered for FFS
- PART 12 - Assessment Of Dents, Gouges, and Dent-Gouge Combinations
- Software review
- Overview and Wrap Up