

Why: Using the fitness-for-service standard method in API 579/ASME FFS-1 (2007) as the primary point of focus, this course will provide background information and usable guidance for those who wish to do fitness for service assessments. These assessments can show the acceptability or lifetime of many types of metal damage. Much of the discussion will be on fracture mechanics concepts used to understand the behavior of cracked materials, but attention will also be paid to local and microscopic damage, such as corrosion material loss and hydrogen damage.

What: The course is aimed at engineers and inspectors with responsibility for designing new metallic structures or making decisions about their continued use, such as choices to repair, replace, re-rate or modify equipment. Participants will gain comfort with assessment method inputs and the types of outputs available. They will also gain insight into the reasons why the methods successfully describe the material behavior. Background material, example assessments and time for discussion will all be part of the course.

Instructor: William C. Mohr – Principal Engineer, Structural Integrity

B.S. Materials Science and Engineering,
Massachusetts Institute of Technology, 1984
M.S. Materials Science and Engineering,
Stanford University, 1986
Ph.D. Materials Science and Engineering,
Stanford University, 1989

TECHNICAL EXPERTISE

Dr. Mohr is a Principal Engineer within the Engineering and Materials group, with responsibilities for initiating, conducting, and reporting research and contract work. He joined EWI in 1993. Dr. Mohr's areas of interest are fitness-for-service assessment, design, and fatigue of welded structures. Prior to joining EWI, Dr. Mohr worked for 3 years for Shell Development Company, where he participated in over 40 fitness-for-service assessments of pressure vessels and piping. His research involved assessment of hydrogen-blistered steel vessels. He also led failure analyses of metal components that failed by fatigue, fracture, and corrosion in refinery service. Dr. Mohr's Ph.D. thesis developed an applied mechanics analysis of creep resistance in particle-hardened alloys. Dr. Mohr has authored more than 30 technical papers and many reports of sponsored projects, failure analyses, and fitness-for-service assessments.

Where: Technical Toolboxes Training
3801 Kirby Dr. #520
Houston TX, 77098

Price: \$1,500.00 per student

FFS COURSE OUTLINE

INTRODUCTION

- Effects of Flaws on Structures
- API 579/ASME FFS-1
- Stress Concentrations
- Stress Intensity Factors
- Limits of Stress Intensity Factors

LINEAR ELASTIC FRACTURE MECHANICS

- The Basics of LEFM
- Types of Fracture Calculations

ELASTIC-PLASTIC FRACTURE MECHANICS

- Including Plastic Deformation in Fracture Assessment
- CTOD Design Curve
- Example Crack in a Pipeline

FRACTURE ASSESSMENT DIAGRAMS

- Putting Fracture and Overload Failure Modes Together in One Diagram
- Failure Boundary Shapes
- Improving Performance at Different Areas of the FAD

RESIDUAL AND THERMAL STRESSES

- Estimating Secondary Stresses
- Applying Secondary Stresses to Fracture Assessment
- Relief of Secondary Stresses by Primary Stresses

INPUTS TO FITNESS-FOR-SERVICE ASSESSMENTS

- Charpy V-Notch Testing
- Fracture Toughness Testing
- Stress and Geometry Tricks

REAL WELD EFFECTS

- Strength Variation across Welds
- Misalignment across Welds



- Strain-Based Design
- Backing Bar Example

DENTS, GOUGES, AND WALL LOSS

- Stress Distribution around Thin Areas
- Stress Distribution for Local Bending
- Pitting Assessment
- Assessment of Larger Wall Loss

FATIGUE OF WELDED STRUCTURES

- Disadvantages of Welded Structures in Fatigue
- Dependence of Fatigue on Weld Properties
- Improving Designs for Fatigue
- Examples of Fatigue Failures

MORE FATIGUE OF WELDED STRUCTURES

- Doing S-N Design Assessment
- Variable Amplitude Loadings
- Reliability Testing
- Fracture Mechanics Approach
- Repair and Fatigue Improvement

CORROSION FATIGUE

- General Corrosion Loss of Wall Thickness
- Corrosion Smoothing of Sharp Notches
- Hydrogen Induced Crack Growth Rate Increase
- Embrittlement

HYDROGEN ASSISTED DAMAGE AND CREEP

- Blister Assessment
- Low Temperature HIC and SOHIC
- High Temperature Hydrogen Damage

ASSESSMENT OF STRESS CORROSION CRACKING

- Stress Corrosion Cracking Process
- Fracture Mechanics for SCC: Growth Rate
- Fracture Mechanics for SCC: Threshold K
- SCC and Corrosion Fatigue of Steels in Hot Water

Course Duration: 2 days
Start Time: 8:15 AM
End Time: 4:30 PM

Sponsored by:



**Please complete the attached form
and fax to TTI at 713-630-0560**

Course Cost: \$1,500.00 per student

Course Date:

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** By signing above I commit to paying the course fee when invoiced*

Terms and Conditions: One registration is required per person. Upon receipt of your above registration, an invoice will be generated for payment. Payment is due 30 days from receipt of invoice. Full price of the course fee will be refunded provided written cancellation is received 3 weeks prior to course date. A cancellation after the deadline will receive full credit towards a future date for the same course.

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