ABOUT THE COURSE

Corrosion is the electrolytic reaction of the material surface with the ambient medium, which leads to erosion or crack formation in the primary material. This is more prevalent with metals.This part of the course will introduce to different types of corrosion and principles of materials. Other lectures will deal with corrosion mitigation and protection and how the corrosion is controlled and managed by corrosion testing and monitoring.and material selection. Finally some case studies of offshore corrosion will be dealt with.

Following a general introduction to fatigue and fracture, with examples of service failures, current and developing fatigue design and assessment methods will be described. The course will go on to explain the importance of crack/flaw analysis in structural design and safety assessment and illuminate its wide range of applicability. It will give a deep understanding of the major results and criteria underpinning modern fracture mechanics, the assumptions behind them and important limitations. Attendees will gain a better understanding of material selection for fatigue and fracture resistance and learn about codified procedures for flaw evaluation

The course will introduce fundamental concepts of Engineering critical assessment / Fitness for service assessments; from stress intensity factor, CTOD and J-integral to methods of measuring and calculating fracture toughness for use in the ECA assessment. The fracture and fatigue crack growth assessment methodology of BS 7910 shall be presented and illustrated with examples

WHO SHOULD ATTEND

Engineers and scientists involved in the design, operation and assessment of both onshore and offshore structures.

COST

The registration fee of the workshop will be £850 + VAT (UK only) which includes course notes and lunches. You should make your own arrangements for accommodation.

PAYMENT

Payments can be made by cheque (made payable to ASRANet Ltd.), cash or bank transfer. Please enquire for details.

VENUE

ASRANet Ltd.
St Georges Building
5 St Vincent Place
Glasgow, G1 2DH
Scotland, UK

NOTE

Please do not make your travel arrangements until you receive an Invoice from us.

CONTACT

ASRANet Ltd.
St Georges Building
5 St Vincent Place
Glasgow, G1 2DH
Scotland, UK
W www.ASRANet.co.uk/courses
E info@asranet.co.uk
T +44 (0)141 248 3040
F +44 (0)141 275 4800

Corrosion, Fatigue & Fracture

22-24 August 2018
Glasgow, UK

PROGRAMME

Wednesday 22nd August

09.00 - 10.30	Lecture 1: Basic understanding of materials and types of degradation mechanisms relevant to offshore structures. *Dr Steve Paterson*
10.30 - 10.45	*Break*
10.45 - 12.15	Lecture 2: Principles of aqueous corrosion, electrochemistry, and the electrochemical series. *Dr Steve Paterson*
12.15 -13.30	*Lunch*
13.30 – 15.00	Lecture 3: Methods for corrosion mitigation and protection, including cathodic protection, coatings, inhibitors and corrosion resistant alloys. *Dr Steve Paterson*
15.00 - 15.30	*Break*
15.30 - 17.00	Lecture 4: Corrosion control and management including testing, monitoring and materials selection. Examples of corrosion.in oil and gas production facilities *Dr Steve Paterson*

Thursday 23rd August

09.00 - 10.30	Lecture 5: Introduction and S – N Curve *Dr Helena Polezhayeva*
10.30 - 10.45	*Break*
10.45 - 12.15	Lecture 6: Effect of Stress Concentration specific to offshore structures *Dr Helena Polezhayeva*
12.15 -13.30	*Lunch*
13.30 - 15.00	Lecture 7: Rules for Fatigue design of Welded Structures, Effects of Random Loads, Mean Stress, Thickness and Material Strength *Dr Helena Polezhayeva*
15.00 - 15.30	*Break*
15.30 - 17.00	Lecture 8: Application of Fracture Mechanics and Post Weld Improvement Techniques *Dr Helena Polezhayeva*

Friday 24th August

09.00 - 10.30	Lecture 9: Fundamentals of fracture mechanics Dr Bostjan Bezensek
10.30 - 10.45	*Break*
10.45 - 12.15	Lecture 10: Determination of fracture toughness Dr Bostjan Bezensek
12.15 -13.30	*Lunch*
13.30 - 15.00	Lecture 11: Engineering Critical Assessment (ECA) *Dr* Bostjan Bezensek
15.00 - 15.30	*Break*
15.30 - 17.00	Lecture 12: Application of fatigue crack growth and fracture assessment examples Dr Bostjan Bezensek

ABOUT THE LECTURERS:

Dr Helena has more than 30 years' experience, and is internationally recognised as a fatigue expert, specialising in the development of spectral fatigue analysis and fatigue assessment procedures for a wide variety of ship types and offshore structures.
Dr Helena also has expertise in fatigue related consultancy and research including fatigue testing and numerical analysis as well as the development and delivery of fatigue training. Helena was awarded a Royal Society Fellowship in 1994 for her Post-Doctoral research

Dr. Steve Paterson, Ph.D, C.Eng. graduated from Imperial College, London, with a B.Sc (Eng.) and Ph.D in Metallurgy. He joined Shell in 1981 and held various roles related to materials, corrosion and welding in the exploration & production, refining and chemical businesses, and worked in the Netherlands, Malaysia, and Norway. In 1999 he moved to Aberdeen where he was responsible for delivery of inspection and integrity services to Talisman Energy. He rejoined Shell in Aberdeen in 2001 to work on subsea development projects, and in 2006 became head of materials and corrosion engineering for Shell's Upstream businesses in Europe. From March 2014 until his retirement in May 2017 he was Principal Technical Authority for Upstream Materials for Shell, based in Amsterdam. He now works as an independent materials and corrosion adviser with Arbeadie Consultants.

Dr. Bezensek holds an undergraduate degree in Mechanical Engineering from University of Maribor, Slovenia and a Doctor of Philosophy degree in fracture mechanics and failure assessment from University of Glasgow, Scotland, UK. He is a Chartered Engineer and member of British standard BS 7910 committees since 2008.

Dr. Bezensek has over 15 years of experience in structural integrity assessments with emphasis on fatigue and fracture of corrosion and crack like defects. His early career focused on the nuclear application and he was a member of the ASME Section XI working group on pipe flaw evaluation as well as contributing to the UK's R6 programme.

In recent years his focus is on the petrochemical (Oil & Gas) sector. He is the subject matter expert on the ECA (Engineering Critical Assessment) for delivery of subsea pipelines in Royal Dutch Shell group and leader in the fitness for service support to upstream and downstream asset.

LECTURE INFO

Lecture 1: Principles of materials and corrosion
Structure of materials
Types of corrosion (atmospheric, pitting, crevice, galvanic, microbial, CUI)
Stress corrosion cracking
Hydrogen embrittlement
Impact of corrosion on fatigue

Lecture 2: Principles of aqueous corrosion
Mechanisms of aqueous corrosion
Electrochemistry
Kinetics of corrosion
Passivity
Electrochemical series

Lecture 3: Corrosion mitigation and protection
Cathodic protection: sacrificial/impressed current
Corrosion inhibition
Coatings and fabric maintenance
Corrosion resistant alloys

Lecture 4: Corrosion control and management
Corrosion testing and monitoring
Materials selection and corrosion management
Case studies of offshore corrosion

Lecture 5: Introduction and S-N Curve
Fatigue mechanism of materials
Fatigue mechanism of welded structures
Fatigue design principles
Fatigue damage models
Uncertainties in fatigue damage prediction
Major factors affecting fatigue life
Origin of SN curve & Fatigue test
Segments of SN curve
SN curve for welded structural details

Lecture 6: Effect of Stress Concentration
Introduction and lessons learned from the past
Definition of stress concentration factor (SCF)
Methods for assessing SCF
Stress concentration in hull structural details
Stress concentration at welds
Finite element modelling for SCF

Lecture 7: Rules for Fatigue design of Welded Structures
Fatigue assessment process for hull and offshore structures
Assessment of local stress in structural details for fatigue analysis
Evaluation of hot-spot stress
Secondary stress
Design SN curve
Strain-Life Criterion-based Approach Basics and Application
Local Strain Methodology
Strain Life Cyclic Curves
Strain-Life Criterion for Fatigue
Evaluation of Local Strain Applications

Lecture 8: Application of Fracture Mechanics
Fracture Mechanics: Basic concepts
Fatigue crack propagation
Stress intensity factor
Evaluation of stress intensities
Evaluation of (residual) fatigue life
Fatigue Crack Propagation: Consequences
Welding Improvement Techniques
Loading and Environmental Conditions
Limitations

Lecture 9: Fundamentals of fracture mechanics
Basics of stress intensity
factor, crack tip plasticity, CTOD and J-integral. Will also discuss the physics of the fracture process.

Lecture 10: Determination of fracture toughness
Fracture toughness testing to BS 7448 and determination of fracture toughness
from CTOD and Charpy data as per BS
7910 guidance

Lecture 11: Engineering Critical Assessment
Concept of failure assessment diagram for fracture assessment and present key steps in BS 7910 fracture assessment procedure . Also includes a few slides on Fatigue crack growth using Paris law.

Lecture 12: Application of fatigue crack growth and fracture assessment examples
Two examples: a ship deck under combined fatigue crack growth and fracture assessment and a pipe under brittle fracture.