

# API 571:

## Damage Mechanisms Affecting Fixed Equipment in the Refining Industry

"Physical Asset Integrity Series"

20<sup>th</sup> -23<sup>rd</sup> February 2022

Principal Course Leader: **Dr.M.S. Parvizi, FICorr, FIM3, CENG**



- ✓ Receiving 2021 NACE Technical Achievement Award
- ✓ More than 40 years' experience in Oil, Gas and Petrochemical Industries
- ✓ NACE International Corrosion Specialist
- ✓ NACE Instructor

**Tehran-Iran**  
20<sup>th</sup> -23<sup>rd</sup> February 2022



20<sup>th</sup> January 2021

[www.matgroup.org](http://www.matgroup.org)

## COURSE OBJECTIVE:

This course is aimed at providing a comprehensive overview of all degradation mechanisms threatening the integrity of Refineries and Petrochemical industries.. This course follows API recommended Practice and provides a general guidelines to the most probable failure mechanisms affecting all equipment and piping utilized in these industries. In addition, this guideline provides informative key areas which can be practiced by plant operator and inspectors to assist in identifying likely causes of damage. This guideline also can assist the operator with the development of inspection strategies to help identify monitoring program to ensure the equipment integrity.

*Training builds morale.  
Investing in people  
demonstrates they  
have a future with the  
organization. To build  
a team of loyal, fully  
engaged, high achievers,  
hire the right people  
then invest in their  
development regularly."*

## WHAT YOU WILL LEARN:

During this course the attendees will be familiar with all the common materials used in the refining and petrochemical industries and be familiar with their behaviour at certain environment and determine the corrosion prevention techniques to handle a safe operation.

## WHO SHOULD ATTEND:

This training course is intended for all professional personnel of the Downstream industries who are engaged in operation, inspection and integrity managements activities and aims to thoroughly understand different damage mechanisms faced in the oil and gas industry. The training course is further recommended for those who wish to thoroughly understand the RP API 571 Damage Mechanisms. This training course is suitable to a wide range of professionals but will greatly benefit:

- Asset Integrity Engineers
- NDT Engineers & Technicians
- Fresh Graduated Mechanical Engineers
- In service inspectors
- All professionals who aim to register for API 571 exam.



## COURSE OUTLINES:

### Day 1:

- Assessment test of the attendees' knowledge of basic corrosion and materials engineering.
- Introduction to materials and Environment classification
- A basic background on Corrosion Key Points
- Low temperature Corrosion Mechanisms:
  - ✓ Atmospheric Corrosion
  - ✓ Corrosion Under Insulation
  - ✓ Galvanic Corrosion / Dealloying Corrosion / Graphitic Corrosion
  - ✓ Pitting/Crevice Corrosion
  - ✓ Flow Assisted Corrosion
  - ✓ Corrosion Fatigue
  - ✓ Environmentally induced Cracking
  - ✓ Chemically Induced Cracking (Ammonia, Caustic, Methanol, HF, Carbonate...)
  - ✓ CO<sub>2</sub> Corrosion
  - ✓ Caustic Corrosion
  - ✓ HCl Corrosion
  - ✓ Sulfuric Acid Corrosion
  - ✓ Ammonium Chloride/Bisulfide Corrosion
  - ✓ Organic Acid Corrosion
  - ✓ Corrosion by sulfuric, phosphoric, Nitric, HF, Hydrochloric and Organic Acids
  - ✓ Polythionic Acid Corrosion

### Day 3:

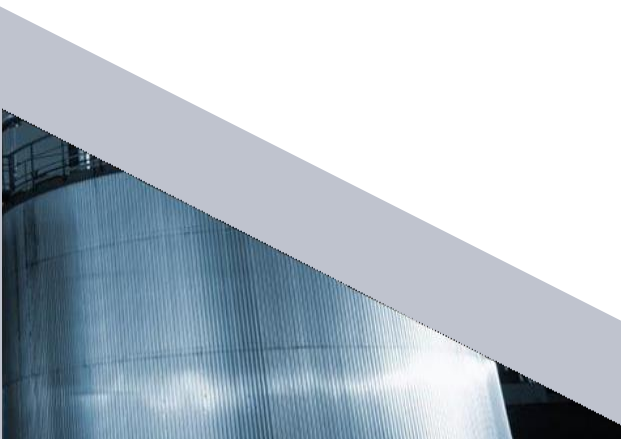
- Materials selection and corrosion Concerns in Refining Units:
  - ✓ CDU
  - ✓ VDU
  - ✓ FCC
  - ✓ Hydro treating
  - ✓ Alkylation

### Day 2:

- Sour Service Failures mechanisms and interpretation of applicable standards i.e. NACE MR0175/ISO 15156 and NACE MR0103.
- Sour water Corrosion
- Cooling Water Corrosion
- Soil Corrosion
- Fundamentals of Corrosion Protection
  - ✓ Materials Selection
  - ✓ Coating
  - ✓ Chemical Injection
  - ✓ Cathodic Protection
  - ✓ Design
- Non-Corrosion related Failure Mechanisms
  - ✓ Brittle Fracture
  - ✓ Fatigue Failure
  - ✓ Over-pressurization
  - ✓ Over-Heating
  - ✓ Over-Loading
  - ✓ Thermal Shock
  - ✓ Steam Blanketing
  - ✓ Refractory Degradation
- Metallurgical /High Temperature Failure Mechanisms
  - ✓ HTHA
  - ✓ Oxidation
  - ✓ Sulfidation
  - ✓ Carburation/Decarburization
  - ✓ Creep
  - ✓ Metal Dusting
  - ✓ Temper Embrittlement
  - ✓ Sigma Formation
  - ✓ Nitriding
  - ✓ Naphthenic Acid Corrosion
  - ✓ Fuel Ash Corrosion
- Welding Related Failures

### Day 4:

- Cat reforming
- Amine Treating Units
- Sulphur Recovery Units
- Inspection methods and Corrosion Monitoring Techniques
- Failure Analysis techniques in downstream Oil and Gas industries
- Discussion and exchange of ideas
- Final examination covering the main course contents taught.





## YOUR PRINCIPAL COURSE LEADER:



**Dr. Sadegh Parvizi** is a Principal Corrosion, Metallurgy and Materials Technologist with over 40 years' experience in Oil, Gas, Refineries, Petrochemical, Power industries and Manufacturing Plants. He has particular expertise in materials evaluation as well as integrity management, remnant life assessment and implementation of corrosion control techniques in these industries. Over the course of his career he has taken a prominent role in investigating and advising on various technical problems, such as selection of materials, optimization of their use, plant failure investigation, Welding/NDT review, CP design review, and technical advice on repair procedure, auditing, writing materials specification.

**Dr. Parvizi** has been involved in technical clarification activities with manufacturers on a number of projects world-wide ranging from the conceptual stage to commissioning and production. He has played an important part in troubleshooting of some major production plants.

**Dr. Parvizi** graduated from the department of Metallurgy and Materials Engineering at Sharif (formerly Aryamehr) University of Technology in Tehran in 1976. He has an MSc in Materials Engineering and a PhD and Postdoctoral degree in Materials Science and Technology from the University of Surrey, UK. His professional career can be categorized into the following distinctive areas:

### A) Research and Development:

Following his MSc degree he was employed as a Research Officer to study the behavior of materials in seawater. This work was sponsored by the International Copper Research Association (INCRA), USA. This work was successfully carried out by the application of electrochemical techniques supplemented by surface analysis to understand the corrosive and fouling behavior of seawater on materials used in a marine environment. This work was concluded by a method of alloy development and treatment. His research work continued and he was subsequently sponsored by British Gas as a Postdoctoral Research Fellow to understand the main mechanism of corrosion of metals by corrosive gases. He then joined ERA Technology in Leatherhead UK working on the Remnant Life Assessment Techniques applied on the aging components of high temperature equipment. Following this work, he joined National Petrochemical Company, Iran and founded Applied Research and Development Centre of NPC to identify and define technical problems of the industry and coordinate projects to be conducted by Iranian research centers and the universities.

### B) Working with the Operators:

Dr Parvizi has worked with Oil and Gas Onshore and Offshore industries such as ADMA-OPCO, ADGAS, and Occidental Petroleum of Qatar and Exxon Mobil for Chemical plants in Singapore. His role in this period was to identify and provide technical recommendation on various corrosion, metallurgy and material integrity issues including:

- Selection of Materials
- Reviewing Material Submission
- Plant Failure Investigation
- Technical Advice on Repair Procedure
- Auditing
- Writing Materials Specification for sour and non-sour services
- Technical clarification activities with manufacturers on a number of projects.
- Involvement in Main Oil Line (MOL) corrosion protection strategy, manufacturing prequalification and Corrosion management activities.
- Involvement in the performance of a corrosion monitoring survey to select and specify the correct corrosion monitoring techniques and location for the offshore facilities including data capture and transmission. Incorporate findings in a report and drawings as appropriate.

### C) Working with Engineering Companies:

He has over 17 years of Experience of working with major International Engineering Companies such as Technip, Bechtel, Foster Wheeler and at present with CB&I. During this period, he has been leading the material/metallurgical/corrosion related activities of any project. He has been engaged in a large number of projects for intake as Paradip Refinery FEED, EPC (as a member of MPMC specialist team), Manifa CPF, BP DF-1, Hydrogen Power of Abu-Dhabi, Conoco-Phillips, Houdini Shell Singapore, Nigerian Madu-Tubu oil gathering and Olokola Gas gathering, Singapore Parallel Train (SPT) EPC consultant to ExxonMobil. In Technip apart from his responsibility in running Materials engineering group he was appointed as a member of Expert Group of Technip Globally.

**Dr Parvizi** is an active fellow member of the Institute of Materials, The Institute of Corrosion, NACE International and Chartered Engineer. In addition, he is a certified Corrosion Specialist of NACE International. He is an approved instructor of NACE to teach Refining Corrosion, Design for Corrosion, Pipeline Corrosion Integrity Management (PCIM) and NACE Basic Corrosion. Dr.Parvizi has lectured on a number of occasions for researchers, engineers and operators. He has developed a dynamic mechanism on the interaction of different disciplines in projects set-up. He has published and presented a number of papers internationally and has been a key speaker at several Corrosion Conferences.



For Further Information Please Contact:

Tel.: +982188553230 FAX: +982188552734

Email: [training@matgroup.org](mailto:training@matgroup.org)