

## Training Title

### API 571 DETERIORATION MECHANISMS

## Training Duration

5 days

## Training Venue and Dates

REF						
ME081	API 571 Deterioration Mechanisms	5	21-25 Jan	\$4,000	Dubai, UAE	

In any of the 5 star hotels. The exact venue will be informed once finalized.

## Training Fees

- 4,000 US\$ per participant for Public Training includes Materials/Handouts, tea/coffee breaks, refreshments & Buffet Lunch

## Training Certificate

Define Management Consultancy Training Certificate of course completion will be issued to all attendees.

## TRAINING OVERVIEW

### INTRODUCTION & DESCRIPTION

In order to proactively improve and enhance the safety reliability and profitability chemical plants and oil field related plant and machinery, it is necessary to understand where why and how the corrosion related mechanisms cause damage which eventually lead to sudden failures, such an understanding of failure mode helps to decide

If a change in process is essential

Or the change in equipment or material is warranted

Or any such change would not have undesirable effects on safety and reliability of plant operation, as every mistaken decision would cost a fortune. This course is an excellent combination of metallurgy, failure analysis, fractography, and Corrosion Sciences.

### COURSE OBJECTIVES

From Corrosion Basics we learn all metal under a given environmental or operational conditions do not behave in the same manner and when the environment changes, the same metal's behavior abruptly changes. From the excellent tools available now in Electrochemistry we are able to follow the failing patterns of metals; and from NDE methods we are able to assess what is going on. Metallurgical and optical tools as Microscopy, enable us to know what caused the damage This course blends all these

modern technology and theory to get an inside out picture of the pains and aches of metals and materials which are subjected to high pressure, temperature and aggressive chemical situations that prevail in any oil field operation. The diagnosis is available on line and offline before or after failure and we get to know how to treat it.

This course is designed to create an understanding of the common corrosion forms, deteriorations mechanisms, corrosion control and corrosion monitoring principals used in oil, gas fields, and other industries in general

### TRAINING METHODOLOGY

A highly interactive combination of lectures and discussion sessions will be managed to maximize the amount and quality of information and knowledge transfer. The sessions will start by raising the most relevant questions, and motivate everybody find the right answers. You will also be encouraged to raise your own questions and to share in the development of the right answers using your own analysis and experiences. Tests of multiple-choice type will be made available on daily basis to examine the effectiveness of delivering the course.

All presentations are made in excellent colorful power point. Nearly a hundred graphics on failure would enable the participant to

- Identify active damage mechanism
- Detect the type and extent of damage using NDE methods
- Identify potential mode of leaks rupture and collapse and structural failures
- Estimate the progress of damage
- Monitor and control the progress of damage mechanism
- A video on Corrosion in action will be shown

### WHO SHOULD ATTEND?

An excellent compilation of material sciences not available in any college curriculum or text and therefore highly recommended to all operational and maintenance and process engineers who are dealing with plant and machinery made of different metals and material every day; for plant inspectors who like to know the changes, losses, deformation and corrosion that takes place when the reactors are operating; the subtle and micro damages that add up day by day and eventually reach an intolerable limit. All technical staff who are working in midstream operation, and gas plants. To all those interested in knowing about damage mechanism covered by API 571. To those involved in repair alteration etc and wish to assess the condition of aged plant before proceeding. Finally for all those interested to know something about failure analysis. A specially tailored seminar with lots of lot graphics not to miss.

### COURSE OUTLINE

## Day 1 Why metals fail?

- Profile of the atom
  - Crystal structure & grain boundaries
  - C as impurity in Iron
  - Environment that affects
  - Corrosion basics

## Day 2 Types of corrosion

- Macro the easy identifiable
  - Galvanic
  - Uniform
  - Pitting
  - Fretting and
  - Filiform
- Flow related
  - Erosion
  - Cavitations
  - Impingement
  - Selective leaching

Where they occur in oil field, their mechanism of failure and extent of damage and impact on reliability

## Day 3 Chemical related problems

- CO<sub>2</sub> corrosion
- Amine corrosion
- Chloride corrosion
- Acid corrosion
- Sour water corrosion
- Flue gas corrosion

What components are affected what is the pattern of failure, how to monitor and control?

- Other types of corrosion

- Microbial induced
- Hydrogen embrittlement
- Corrosion under claddings
- Stray current

Where do they occur in the plant and piping; how to monitor and control?

#### Day 4 Stress corrosion

- SCC in
  - Carbonate
  - Caustic
  - Naphthenic acid
  - Ammonia
  - Polythionic acids
  - Chlorides

Which are the metals affected and in which part of the plant?. Failure patterns cause and remedy

- Stress and fracture
  - Stress rupture
  - Creep rupture
  - Brittle fracture
  - Ductile fracture
  - Fatigue fracture
  - The many faces of wear

Patterns of fractography to indicate intergranular and intragranular failure mechanisms

#### Day 5 Temperature induced failures

- Oxidation
- Carburisation
- Decarburisation
- Sulphidisation
- Metal dusting
- Weld decay

## Failures in selection of material

- Wrong selection
  - Material composition impurities
  - Rolling forming and extrusion defects
  - Cold and residual stresses
  - Fabrication and assembly stresses
  - Welding heat affected zone/ crystal morphology
- Each lecture has practical. A Manual for Practical with Sketch will be Provided

Case Studies, Group Exercises, Group Discussions, Last Day Review & Assessments will be carried out.

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