Training Title
Corrosion in Oil & Gas Installations

Training Venue and Dates

| Corrosion in Oil & Gas Installations | 18-22 Nov | $3,300 | Doha, Qatar |

In any of the 5 star hotel. The exact venue will be informed soon. Fees Includes Course Materials/Handouts, Tea/Coffee, refreshments, International Buffet Lunch.

Training Fees
- 3300 US$ per participant for Public Training

Language: English

TRAINING OVERVIEW

INTRODUCTION & DESCRIPTION.
The annual losses due to corrosion and the cost of rectification run to several billion dollars in most of the countries. High production under aggressive and extreme operational conditions necessitates the development of new materials which also have peculiar failure patterns. Thus mankind is on continuous experimentation with products and processes. Yet material failure not only entails in loss of production but loss of life as well. Prediction of failure pattern, residual life measurements, preventive measures are all approaches in corrosion studies for safe and economic operation of plant and machinery.

TRAINING OBJECTIVES
This course aims to provide the participants with an understanding of why and how corrosion occurs, and how the environment in the gas and oil installations is aggressive to iron and steel equipment, plant and structures. It is designed to give a practical approach to control corrosion, and prevent failures. Presented are the basic concepts of corrosion, the metallurgy of iron and steel, and the mechanism of failure. Participants learn the state of art of corrosion control and be able to apply it in day-to-day work, thereby ensuring safety, plant reliability and economy. It is an update of Corrosion problems which affect the oil and gas production and reduce the plant integrity. It necessitates an understanding that ageing plants can cause catastrophic failures and underlines the importance and methodology of inspection. This also imparts an awareness of the emerging technologies for corrosion control and failure.
prevention. Interactive discussions on photographs of plant failures and a working methodology of failure analysis reinforce the understanding of the theory taught.

WHO SHOULD ATTEND
Process Engineers, Inspection Personnel, Mechanical Engineers, Material Selection Personnel and Corrosion Personnel. For all technicians, supervisors and maintenance staff who are interested in knowing why some components fail more often than expected- A Corrosion awareness for all Plant Engineers who are interested in learning the fitness for service of plant and equipment they are handling- For Safety Engineers who are interested in health safety and environment in case of unintended plant failure-for Finance Managers who are interested in knowing what affects production and asset management- and for all those who want to know more about inspection and monitoring.

This is a value added package

TRAINING METHODOLOGY
A totally revamped, tailored lecture, not following the conventional method of teaching the classical theory and principles but beginning with the day to day problems seen all over the world in oil and gas installations and explaining the basic principles to the necessary minimum avoiding chemistry and equations which are of academic interest only..

1. All lectures are interspersed with interactive discussion
2. Pictures of real incidents and case history are shown first and Theory comes next
3. Home works are given each day to relate study to real life situations
4. Live corrosion in action demo is included in some lecture sessions
5. All lectures are in colorful PowerPoint presentation.
6. A video on corrosion in action is shown
7. Student receive a Manual or work book
DAILY COURSE OUTLINE

Day 1

The importance of the study

- **Introduction**
  - Corrosion and society
  - What is corrosion?
  - Why is it important?
  - The social, economical and environmental impacts

- **Lessons from history**
  - The liability due to corrosion
  - Interactive session on causes and possible avoidance
  - From the known to the unknown

- **The three classification of failures**
  - Metallurgical
  - Mechanical
  - Electrochemical

- **What the metallurgists failed to see**
  - Metallurgical
  - Thermodynamics- the energy transfer principles
  - Why different metals react differently in same situation-Galvano’s experiments
  - The atoms and electrons that matters- Niels Bohr’s experiment
  - Live demo on corrosion in action

- **Home work**
  - Describe one plant and machinery handled by you
  - What are the various auxiliaries connected to it or what different metals are used in that fabrication

Day 2
Environment stronger than metals

- Why metals fail often and more than in the past
- Gas and oil installations- some process diagram
- Steel-One metal in different aggressive environment

- Gaseous environments- H2S, oxides of sulphur, carbon dioxide organo compounds, chlorine, ammonia
- Liquid environments- crude, salt and seawater, wash water, effluents, bacteria
- Solid environment- soils, sulphur, catalysts, trace metals
- Pourbaix experiments and principles
- Live demo on corrosion in action

Learning to handle failures - Corrosion Basics

- Definition of corrosion
- Grouping the information from the photographs of failures
- The eight forms of corrosion
- Evolving a theory based on failure analysis – cause and effect
- Relating to metallurgical, mechanical and electrochemical

- One more finding-operational factors also influence corrosion
- Velocity – impact on steel and stainless steel
- Temperature- high temperature and oxidation, cryogenic
- Pressure – pipeline systems, reaction towers and storage vessels
- Discussion on photographs showing failures due to stagnancy, erosion, cavitations, rupture, explosions - what factor was responsible for failure?

- Home work

- Write a process diagram (indicate operational factors)
- What are the input and output (product impurities that affect plant performance)

Day 3
First step to control

- Measurement of loss (corrosion)
- Faradays electric laws
- Four components of corrosion cell
- Tools that can be used in field- known simple NDT Techniques-UT, PT and RT
- What do they tell us?

- Mechanism of Corrosion
- Tools that are used in field and laboratory-microscopy, electrochemical analysis,
- What do they tell us?
- More sophisticated tools –just know about them

- Some special corrosion problems related to oil and gas installations;
- High temperature oxidation
- Microbiologically induced corrosion

- Home work

- What are the operative conditions that affect production?
- What are the failures noted in the past – by what tools?

Day 4
Step two- Preventive control

- Mechanical aspects
- Innovative Vs iterative Design
- Fabricational issues

- Metallurgical
- Material selection vs environment
  - Galvanic effect
  - Flow and velocity effects
  - Temperature and creep effect
• Stress
  o Chemical and electrochemical

  Coating painting and lining
  o Deft definition
  o Classification and types for different environmental conditions
    § For atmospheric
    § Buried
    § Submerged
    § Internal

  o Importance of Surface preparation & application
  o Why Coating defects occur and the causes of failure
  o Insulation & Lining materials- high temperature appliances- furnaces, chimney
  o Under cladding issues- high temperature- energy losses and safety

Chemicals for fouling & corrosion control

  o Selection of inhibitors for
    § Production & recovery
    § Pipeline & tanks
    § Cooling water
    § Acid systems
    § Boiler water

  o Dosing methods
  o Economics and control

Home work

  o What are the type of maintenance/ preventive method used to measure avoid and control failure? What are the merits in each of them?
  o What do you know more than safety personnel?
Day 5
Ensuring reliability- Step three- Electrochemical and hi tech methods

Cathodic Protection

- Principles of CP
- Galvanic and Impressed systems
- Selection of material and design
- Pitfalls and failure
- Monitoring and control

Internal line Inspection

- Planning for pigging of line
- Various types of pigs
- Data acquisition and study
- Cost and limitations

Discussion

- Corrosion awareness is important for operators/inspection staff or maintenance staff?
- Does corrosion awareness help in plant reliability, quality, productivity, and asset management

Video on Corrosion will be shown
Relevant Case Studies, Group Discussions, Last Day Review, Pre & Post Assessments will be carried out

TRAINING OUTCOME:
At the end of the course, the delegates will be able to understand:
1. Characteristics of corrosion in oil & gas installations and identify its driving force
2. Ways in which corrosion incurs a cost
3. Methods to minimize and prevent corrosion
4. Appropriate monitoring techniques to establish if there is a potentially corrosive situation.
5. Important material and environmental factors that influence the corrosion process
6. Describe the various methods available for corrosion control, regulatory and safety matters
7. Identify the contribution of an integrated monitoring and inspection program for operations and the diagnosis of problems