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9.30 a 18.00; virtual course

Member Price, 1600 Euros
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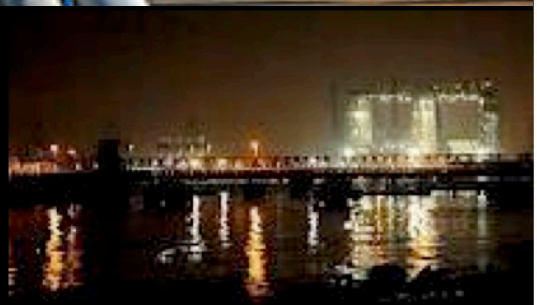
Cursos Nace International

CORROSION CONTROL IN THE REFINING INDUSTRY



Nace international y Europea de Ingenieros en corrosión SAL

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Course Topics

The following topics are included in *Corrosion Control in the Refining Industry*:

- Corrosion and Other Failures
- Crude Distillation and Desalting
- Fluid Catalytic Cracking Unit
- Cracked Light Ends Recovery (CLER) Units
- Hydrofluoric Acid Alkylation Units
- Sulfuric Acid Alkylation Units
- Corrosion in Hydroprocessing Units
- Catalytic Reforming Units
- Delayed Coking Units
- Amine Treating Units
- Sulfur Recovery Units
- Process Additives and Corrosion Control
- Corrosion Monitoring Methods in Refineries
- Refinery Injection Systems
- Materials of Construction for Refinery Applications
- Refinery Operations and Overview
- Failure Analysis in Refineries

Chapter 1: Corrosion and Other Failures

Introduction .
Low-Temperature Refinery Corrosion
Low-Temperature Corrosion Principles
Corrosion Rates and Polarization
Temperature and Concentration
Low-Temperature Conditions.
High-Temperature Refinery Corrosion
High-Temperature Corrosion Principles.
Linear Rate Law
Parabolic Rate Law .
High-Temperature Conditions .

Corrosion/Failure Mechanisms .
Metal Loss—General and/or Localized Corrosion.
GalvanicCorrosion
Pitting .
CreviceCorrosion
Intergranular Attack .
Erosion-Corrosion .
Hydrogen Chloride .
Ammonium Bisulfide (NH4HS) Carbon Dioxide .
Process Chemicals .
Organic Chlorides
Aluminum Chloride .
SulfuricAcid
Hydrofluoric Acid .
Phosphoric Acid.
Phenol(CarbolicAcid)
Amines .
Atmospheric (External) Corrosion.
Corrosion Under Insulation (CUI)
High-Temperature Sulfide Corrosion (Without Hydrogen Present)
High-Temperature Sulfide Corrosion (With Hydrogen)
Naphthenic Acid Corrosion .
High-Temperature Oxidation.
StressCorrosionCracking(SCC)
Chloride Stress Corrosion Cracking (ClSCC) .
Alkaline Stress Corrosion Cracking (ASCC) .
CarbonicAcid(WetCO2)
PolythionicAcidStressCorrosionCracking(PTASCC)
Ammonia Stress Corrosion Cracking (NH3 SCC) .
WetH2SCracking
Hydrogen Blistering .
SulfideStressCracking(SSC)
HydrogenInducedCracking(HIC)
Stress Oriented Hydrogen Induced Cracking (SOHIC) .
HydrogenCyanide(HCN)
SCC Prevention.
Inspecting for Wet H2S Damage .
High-Temperature Hydrogen Attack (HTHA) .
MetallurgicalFailures .
GrainGrowth
Graphitization
Hardening
Sensitization .
Sigma Phase .

Corrosion Monitoring in Crude Units . Water Analysis (Overhead Corrosion Control)
Hydrocarbon Analysis
Corrosion Rate Measurement .
On-Stream, Non-Destructive Examination
Optional Team Exercise

Chapter 3: Fluid Catalytic Cracking Units

Introduction .
Hardware .
Riser/Reactor
Regenerator .
Flue Gas System.
Fractionator
Corrosion Control in FCC Units
Materials of Construction
Damage Mechanisms and Suitable Materials
Reactors
Regenerators.
Catalyst Transfer Piping System .
Reaction Mix Line, Main Fractionator, and Bottoms Piping .
Flue Gas Systems .
Inspection and Control Considerations
High-Temperature Oxidation
High-Temperature Sulfidation (H2S Attack) High-Temperature Carburization .
Polythionic Acid Stress Corrosion Cracking CatalystErosion
Feed Nozzle Erosion.
Refractory Damage .
High-Temperature Graphitization.
SigmaPhaseEmbrittlement
885°F (475°C) Embrittlement .
CreepEmbrittlement
High-TemperatureCreep
Thermal Fatigue .
OptionalTeamExercise

Chapter 4: Cracked Light Ends Recovery Units

CLER Process Description
Materials of Construction
Columns
Exchangers
Corrosion Problems
Corrosion
Hydrogen Induced Damage
Inspection Techniques for Hydrogen-Induced Damage
Prevention and Repair Techniques . Ammonia Stress Corrosion Cracking
Carbonate Stress Corrosion Cracking. . Fouling/Corrosion of Reboiler Circuits

Reactor Section Corrosion
TowerOverheadCorrosion
Reboiler Corrosion and Fouling Control .
Acid Tanks
Corrosion Control During Unit Shutdowns
Corrosion Under Insulation (CUI) .
CorrosionMonitoring
Inspection.
Reaction Section
TreatingSection
FractionationSection
Refrigeration Equipment.
Acid Tank .

Chapter 7: Hydroprocessing Units

Introduction
Hydroprocessing
Hydrotreating
Hydrocracking
Variations on Hydroprocessing
Types of Corrosion Common in Hydroprocessing Units
High-Temperature Hydrogen Attack
High-Temperature H2S Corrosion – With Hydrogen Present .
High-Temperature H2S Corrosion – With Little or No Hydrogen Present
NaphthenicAcidCorrosion
Ammonium Bisulfide Corrosion
Chloride Stress Corrosion Cracking (SCC)
Failures Often Happen After Startup
Additional Considerations with Stainless Steel
Polythionic Acid (PTA) Stress Corrosion Cracking
Stainless Steels Used to Prevent PTA
Other Methods to Prevent PTA SCC
WetH2SCracking
SulfideStressCracking(SSC)
Hydrogen Induced Cracking (HIC) and Stress-Oriented Hydrogen Induced Cracking (SOHIC)
MaterialPropertyDegradation Mechanisms
TemperEmbrittlement
HydrogenEmbrittlement
SelectionofMaterials
ReactorLoop–General
Reactor Feed System
Reactor Feed Furnaces
Reactors
Reactor Effluent System
Reactor Effluent – Distillation Feed Exchangers

Introduction
Definitions
Injection Point
Injection System
njectionSystemDesign
InjectionSystemDesignParameters
EngineeringPractices
ProcessDesign
Materials Selection Considerations
Inspection of Injection Point Locations
Location of Injection Point
Co-Injectants
Injection System Hardware.
Chemical Storage Tanks
Chemical Injection Pumps
Additive Control Systems
PipingSystems
Injector .

Chapter 13: Process Additives and Corrosion Control

Introduction
Factors Affecting Corrosion
Acids
Temperature
Pressure.
Flow
Turbulence
Material Selection
Methods to Mitigate Corrosion
Desalting and Caustic Injection
Water Washing
. Acid Neutralization.
Barrier between Metal and Environment Chemicals Used to Combat Corrosion .
FilmingAmines
Filmer Formulation
FilmerApplication
TreatRates
Monitoring Filmer Performance
Neutralizing Amines
Polysulfides
Naphthenic Acid Corrosion Inhibitors .
Application of Corrosion Inhibitors

Chapter 14: Corrosion Monitoring in Refineries

Introduction
Uses of Corrosion Monitoring

Corrosion Monitoring Techniques.
Corrosion Coupons
Electrical Resistance Monitoring
Electrochemical Corrosion Monitoring Linear Polarization Resistance
Potential Monitoring
Zero Resistance Ammetry (ZRA
. ElectricalImpedanceSpectroscopy(EIS)
Electrochemical Noise (EN)
Hydrogen Flux Monitoring.
A Comprehensive Corrosion Monitoring Program
CorrosionMonitoringSites
Corrosion Monitoring in Specific Process Units
Atmospheric Distillation Unit (ADU)
Vacuum Distillation Unit (VDU
Fluid Catalytic Cracking Unit (FCCU) Amine Treating Unit (ATU)
Sour Water Stripper Units (SWSU
Sulfuric Acid Alkylation Unit (SAU) .
Automated On-Line Monitoring.
Chapter 15: Materials of Construction for Refinery Applications
The Role of the Corrosion Engineer Problem Definition
Corrosion Failures
Corrosion Testing Methods
Materials Selection Approach
Using Professional Consultants . Specifying Materials
NationalStandards
CompanyStandards
What the Designer Should Remember When Writing Specifications
Questions the Designer Should Ask to Control Quality
FitnessforService
Refinery Materials of Construction
Introduction
KilledSteel
Steels.
Carbon Steel
C-MoSteels
Low-AlloySteels
Cr-MoSteels
NickelSteels
Stainless Steels
Martensitic Stainless Steels
Ferritic Stainless Steels
Austenitic Stainless Steels
Precipitation Hardening Stainless Steels
Duplex Stainless Steels

Introduction
Procedural Approach and Test Methods
Background Information
Initial Examination
Nondestructive Testing.
Surface Deposit Analysis
FieldMetallographicReplication(FMR)
HardnessTesting
ChemicalAnalysis
Magnetic Particle Inspection (MPI)
Wet Method .
Dry Method
Dye Penetrant Testing (PT)
Sectioning.
Macroscopic Examination of Fracture Surfaces.
Microscopic Examination
Fracture Appearance
DuctileFracture
BrittleFracture
FatigueFractures
h Corrosion
Stress Corrosion Cracking
Creep Rupture Failures
Additional Testing and Analysis.
Mechanical Testing
Application of Fracture Mechanics Root Cause Analysis.
Recommendations