Cathodic Defence for Harbour Structures

Harbour structures' corrosion protection using cathodic defence.

Introduction

In most industries, corrosion is a prevalent and costly issue. It is particularly evident in the chemical, oil, and gas, and petrochemical sectors, where pipelines and storage tanks are most vulnerable to it. Understanding how to minimise and, in certain situations, completely eradicate corrosion can be highly beneficial.

Any business seeking to avoid the enormous costs that can be directly or indirectly linked to corrosion must have a solid understanding of corrosion and how to control it.

Numerous methods exist that are intended to prevent corrosion in important parts and systems. Cathodic Protection is one unique and significant method of minimising corrosion. This method can be separated into Impressed Voltage and Sacrificial Anode.

The basic concepts, assessment, and applications of cathodic protection are covered in this 5-day Course N Carry Cathodic Defence for Harbour Structures training course. This will assist participants in identifying and choosing appropriate cathodic protection control strategies.

The cathodic protection and corrosion of port infrastructure, such as storage tanks, pipes, and concrete buildings, will receive special attention.

Objectives

- Recognise the fundamentals of corrosion and corrosion prevention strategies.
- Recognise the many forms of corrosion
- Knowing how to prevent corrosion on port infrastructure, such as storage tanks, pipelines, and concrete buildings
- Recognise the impressed current and sacrificial anode cathodic protection systems.
- Recognise the variations amongst sacrificial anode systems.
- Recognise the basic concepts of impressed current cathodic protection.
- Understand how coating qualities affect cathodic protection and how they affect it.
- Recognise the techniques used in coating and line inspection.
- Discover how to do basic field measurements for applications using cathodic protection.
- Discover how to measure line currents.
- Find out more about concert structure upkeep, restoration, and corrosion examination.
- Recognise and apply the mathematical formulas underlying cathodic protection.
- Procedures for corrosion testing and analysis of findings

- Recognise the financial factors of Cathodic Protection systems

Training Methodology

To optimise the advantages to the participants, this Course N Carry Cathodic Defence for Harbour Structures training course includes organised, targeted lectures, discussions of subjects covered with pertinent examples, and question-and-answer sessions.

There will be more films and simulations used. Complete course notes and electronic versions of all presentation materials will be sent to participants. These will be invaluable for in-depth research and future use.

Organizational impacts

- Pressure equipment, piping systems, and process equipment are just a few of the structures and components for which the company will achieve enhanced and optimised corrosion protection.
- Cathodic protection parameters that are optimised will extend and forecast the life of equipment and components in a variety of corrosion scenarios.
- Maintenance and material selection, along with appropriate Cathodic Protection corrosion reduction criteria, will greatly minimise damage to process equipment and failure-related risk.
- Enhanced competences will lead to increased employee effectiveness and productivity.
- The business will see improvements in financial performance, safety, and loss prevention.

Personal Imapct

- Participants will acquire a solid and useful grasp of the types and concepts of corrosion related to water, gas, and oil.
- Additionally, participants will gain more knowledge about cathodic protection techniques and various forms of corrosion inspection, with a focus on port facilities.
- With regard to process equipment, participants will have a greater understanding of corrosion maintenance, corrosion troubleshooting, and corrosion cost minimization

Who should attend?

Employees who require a fundamental understanding of cathodic protection, corrosion concepts, and how to remove or safeguard concrete structures, pipelines, equipment, and storage tanks.

The following people would benefit from this Course N Carry Cathodic Defence for Harbour training course:

- Engineers
- Examiners
- Supervisors
- Metallurgists
- Technologists

Course Outline

Day 1

Types and Principles of Corrosion

- An Introduction to Corrosion Principles
- Cycle of Corrosion
- The corrosion reaction's kinetics
- Reactions Electrochemical
- Reactions, Both Anodic and Cathodic
- Series Galvanic

Forms of Corrosion

- Construction Materials: Types and Properties of Steel
- Types of Corrosion
- Even Russeting
- Dual-Metal Corrosion
- Pitting Corrosion
- Corrosion of concentration cells
- Cracking Stress Corrosion
- Corrosion Erosion
- Weariness and Corrosion

Day 2

Cathodic Protection Types

- Pipe-to-soil potentials as a criterion of cathodic protection: electrodes, electrode location, pipe line connection, surface potential assessment for corrosion
- **Soil Resistivity**
- Units of resistivity, soil types, area surveys, and determination of resistivity at two and four terminals
- **Prospective Surveys**

- Pipe-to-soil potentials as a criterion of cathodic protection: electrodes, electrode location, pipeline connection, surface potential assessment for corrosion
- **Line Currents**
- Cathodic Protection testing, IR tests, current distribution and attenuation, stray-current studies, long-line currents, measurement of line current in test section

Day 3

Corrosion of Concrete

- Impurities in Concrete Constructions
- Concrete Structures: The Corrosion Process
- Timeline for Concrete System Corrosion
- Environmental Influence
- Macro-cell Steel Reinforcement Corrosion
- Concrete's Alkalinity and pH Levels
- Hydroxides' Effect
- The impact of solutions and aggressive agents, seawater, carbon dioxide, etc.
- The process of carbonation
- Chloride Pollution
- Chloride Limits for Different Concrete System Types: Pre-stressed, Reinforced, etc.
- Infiltration into Concrete Constructions
- Permeability and Porosity
- Concrete Cracks Caused by Corrosion

Day 4

The Basics of Electrochemical Protection

- **Ground Beds, Cathodic Protection Systems, and Installation**
- Galvanic (sacrificial) anode and impressed current cathodic protection systems, types, permanent and temporary ground beds, design, installation, and applications, ground beds and installation, galvanic anodes connection to structure, location and function of galvanic anode test station
- Impressed Current Test Stations, Distributed Impressed Current Cathodic Protection Systems, Types of Impressed Current Anode Beds, and Installing Impressed Current Rectifiers
- Cable Connectors
- **Issues with Cathodic Protection, Risks, Security, and Management**
- Identifying and managing interference, Location of the anode bed, resistive and direct bonding, non-conductive barrier, stray currents, Foreign Line Interference with Insulating Joints
- **Concrete, storage tanks, pipelines, port infrastructure, etc. are all subject to cathodic protection.**
- **Types of Anodes and Beds**
- **Coatings for Pipes**

- Coating Types: Metallic, Polymer, Fusion Bonded Epoxy, and Coating Efficiency
- **Testing and Inspection of Coatings**
- Inspection techniques for construction, coating or leakage conductance, coating tests, and pipe coating holidays (loss of coating)
- **Interference from Cathodic Protection**
- Auxiliary Drainage, Foreign Lines, Crossing Bonds, Sources and Detection of Stray Currents, Secondary Exposure, and Basic Solutions

Day 5

Concrete Structure Restoration and Cathodic Protection

- **Concrete Structure Restoration and Cathodic Protection**
- Anode Mesh and Sacrificial Concrete Anode Systems
- Anodes for Thermal Spray
- Steel Reinforced Coatings
- Concrete Repair and Rehabilitation
- Determine Other Options for Rehabilitation
- Appropriate Standards
- **Concrete Survey Techniques**
- Identifying Potential Sources of Failure
- Inspections, both preliminary and detailed
- Survey on Delamination
- Testing and Core Extraction
- Non-destructive Evaluation to Identify Cracks in Concrete
- Crack Evaluation
- Survey with Pachometer (Cover)
- Cholesterol Content Calculation
- Measurement of Moisture Content
- Potential of a Half-cell
- **Techniques for Maintaining and Monitoring Cathodic Protection**
- Close Interval Potential Survey (CIPS) technique, Direct Current Voltage Gradient (DCVG) technique, Pearson surveys, pipe and coating monitoring, and signal attenuation coating (SAC) survey
- **Cathodic Protection Equations and Mathematical Calculations**
- Worked examples and group activities to determine and compute the necessary current, circuit resistance, rectifier voltage, type and quantity of anodes, life cycle cost, and expectation.