Materials and Corrosion Engineering Consultancy Services

CORMAT

YOUR PARTNER IN MATERIALS AND CORROSION ENGINEERING SOLUTIONS

Contents

Introduction

Who We Are

Cormat is an ISO 9001 certified, independent engineering services group assisting Clients in materials selection engineering, corrosion management, risk assessments and corrosion audits, developing project specifications, and developing inspection plans for the oil & gas, refinery, petrochemical, carbon capture, power, LNG, and hydrogen facilities and plants.

Our vision is to provide the best technically viable and cost effective solutions without compromising on integrity and quality; attain absolute satisfaction of our clients. Our experience ranges from Gas/Condensate plants to FLNG plants, LPG Plants, sweet/sour plants, offshore/onshore plants, and pipelines (onshore/buried/sub-sea), carbon capture storage facilities and have covered Europe, Asia, Middle East, Americas, and CIS regions.

Within the Cormat brand, there are three operating companies to cover various regions.

- **Cormat Group Ltd**
- **Cormat UK Ltd**
- **Cormat Consulting Pvt Ltd**

Our most valuable strength lies in our skilled and seasoned workforce, comprised of experts across various aspects of materials selection and corrosion management. They excel in multitasking, possess high levels of motivation, and stand ready to cater to the needs of our clients and the local community we call home.

Our aim is to help our clients select materials right the first time round and implement effective Corrosion Management System further strengthening client's Asset Integrity strategies, substantially lowering operational expenses and consequently reaching the most optimised life cycle cost of their projects and assets.

> "We are excited about the prospect of partnering with you!"

Our Vision & Values

Our Vision

To provide best technically viable and cost-effective solutions without compromising on integrity and quality; attain absolute satisfaction of our clients.

Our Values

To be a good corporate citizen in all its activities. Our business relationships are based on our core values of accountability, excellence, honesty, teamwork, and integrity. The management of the environmental and social issues play a part in our business decisions and are the foundations of good corporate governance.

Our Quality Policy

To perform the work keeping the Integrity & Quality intact and exceeding the expectations of the customers within the statutory and regulatory requirements. We endeavor to continually improve the effectiveness of our quality management system leading to improved level of services for our valuable customers.

Our HSE Policy

We approach every job with safety as our extreme importance. We strive to create the safest possible working environment with daily on-site briefings by each site supervisor focusing on general safety practices as well as specific job-site situations. Conduction Toolbox Talks before start of day activities related to the activity.

At Cormat, safety is not a buzzword. It's a philosophy that permeates through our entire organization. Every Cormat employee participates in extensive, on-going safety training programs and certification.

Our Presence

Cormat provides services globally to the energy industry including Oil & Gas Plants, Power Plants, Refineries, Petrochemical Plants, Carbon Capture Project, LNG, Hydrogen Projects, for both onshore and offshore.

We have expertise in materials selection and corrosion management of carbon capture and hydrogen projects assisting our clients reducing their carbon footprint.

Based on the projects we have delivered, we have a very strong presence in the Middle East and cover all regions from the USA to the fast east Asia (including Indonesia, Malaysia, and Australia).

We cover projects all the way from Concept Development, FEED, Detailed Design, Procurement, Commissioning, Operations to Life Extension. This ensures a complete cycle of integrated service from the assets' inception to either its decommissioning or its extended life.

8+
YEARS OF EXPERIENCE

20+
SATISFIED CLIENTS

45+
PROJECTS COMPLETED

Our Services

Materials Selection Engineering

- Materials Selection Philosophy
- Materials Selection Report
- Corrosion Monitoring Philosophy
- Cathodic Protection Philosophy
- Materials Selection Diagrams
- Vendor Package Materials Selection Review
- Corrosion Calculations
- Review of P&IDs & Piping Materials Specification
- Review of Datasheets
- Galvanic Corrosion Management
- Sour Service Management
- Materials Optimisation Studies
- Materials & Corrosion Audits (MCA)
- Licensor Materials Selection Validation
- Input for Piping Class Summary Table
- HAZOP Actions Support
- Compliance Verification for Client Standards e.g., DEM-1 compliance.
- Project Specifications

Corrosion Management

- Corrosion Management Strategy
- Corrosion Management Plan
- Identification of Damage Mechanisms
- Identification of Corrosion Loops
- Corrosion Loops Diagrams
- Corrosion Mitigation Methods
- Chemical Injection & Wash Water Locations
- Selection & Testing of Corrosion Inhibitors
- Inspection Plan Development
- On-Stream Inspection Plan
- Condition Monitoring Locations (CML) Mark-up on Isometrics for Piping and Datasheets for Equipment
- Risk Based Inspection (RBI)
- Corrosion Risk Assessment Study (CRAS)

Painting & Coatings

- Atmospheric Corrosion Category Identification as per ISO 12944 and/or Client Standard
- External Coating Specification
- Internal Coating Specification
- Pipeline Coating Specification
- Field Joint Coating Specification
- Pipeline Bends Coating Specification
- Riser Coating Specification
- Develop Coating Maps

Miscellaneous

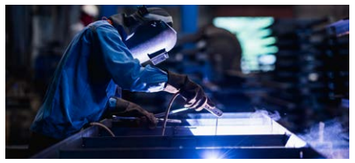
- Project Management Consultancy
- As Built & Drafting Services
- ADHOC Materials & Corrosion Engineering Services
- Vendor Bid Evaluation Support
- Frame Agreements or Master Services Agreements

Cathodic Protection

- Cathodic Protection of Buried Piping
- Cathodic Protection of Buried & Subsea Pipelines
- Cathodic Protection of Structures
- Cathodic Protection of Hull
- Internal Cathodic Protection of Tanks & Equipment
- Project Specifications

Asset Integrity & Life Extension

- Current Asset Condition Assessment
- Sour Service Assessment (Field Souring)
- Remnant Life Assessment (RLA)
- Fitness for Service Assessment (FFS)
- Life Extension Studies
- ILI Data Analysis
- Historic Corrosion Data Analysis
- Corrosion Data Trends Development
- Pipeline Buckling & Fatigue Study
- ECA Study
- Operating Manuals



Welding Engineering

- Welding & NDE Specification
- Specification for Cladding & Weldoverlay of Piping & Equipment
- Specification for Cladding & Weldoverlay of Pipelines
- Specification for Mechanically Lined Pipe
- WPS Reviews

Materials Selection Engineering

Materials selection is a specialized field and thus it must be performed by qualified and experienced specialists. Not only it can affect the cost of equipment substantially but also can pose a significant threat to integrity, safety of plant and humans and production. Materials selection specialist must understand the plant processes so that process upsets are identified correctly and integrity operating windows are established and incorporated into design.

Likewise, materials selection experts must have thorough knowledge and experience of corrosion damage mechanisms so that correct corrosion assessment can be done for given materials vs environments and a suitable mitigation measure is recommended. Knowledge and experience about different metals, alloys and non-metallic materials and their limitations for different applications and environments are very important.

There are few long lead items for whom material selection, corrosion allowance and chemical injection decisions have to made at early phase of project such as concept select phase. In such situations, usually enough process information is not available and thus materials selection experts must utilize their experience and good engineering judgement for material selection.
Our experts have required qualifications, trainings, certifications, skills, and experiences to support our esteemed Clients for all stages of a project i.e., Concept select, FEED and EPC.

Benefits of Materials Selection Engineering:

- Ensures cost efficiency via a balance between OPEX and CAPEX with the selection of the 'Right First Time' materials.
- Operational Reliability
- Safety & Environmental Compliance
- Minimizes the risk of material failure, chemical reactions & contamination, contributing to the overall efficiency and reliability of the processes
- Optimised performance and efficiency

Deliverables & Activities

- Materials Selection Philosophy
- Materials Selection Report
- Corrosion Monitoring Philosophy
- Cathodic Protection Philosophy
- Materials Selection Diagrams
- Vendor Package Materials Selection Review
- Corrosion Calculations Report
- Review of P&IDs & Piping Materials Specification
- Review of Datasheets
- Galvanic Corrosion Management
- Sour Service Management
- Materials Optimisation Studies
- Materials & Corrosion Audits (MCA)
- Licensor Materials Selection Validation
- Input for Piping Class Summary Table
- HAZOP Actions Support
- Compliance Verification for Client Standards e.g., DEM-1 compliance.
- Project Specifications
- Review of Vendor Technical Bid Evaluations & Detailed Vendor Documents

Typical Components Covered in Materials Selection Documents

- Process & Utility Piping, Flanges, Gaskets
- Valves & valve trims
- Vessel Shell, Head, Internals, Dip Pipes, Boot Materials, Trims
- Column, Shell, Head, Trays, Packing Materials, Trims
- Heat Exchanger Shell/Header, Tubeside, Tubes, Plate Materials, Fins, etc.
- Tanks
- Rotating Equipment (pumps & compressors: Casings, Internal wetted/non-wetted parts, sealing materials, etc.).
- Internal & External Bolting Materials
- Onshore & Buried Pipelines
- Offshore & Subsea Pipelines
- Flexible Pipelines
- Flexible & Rigid Risers & Spools
- Non-metallic Tertiary Structural Steel
- Corrosion Monitoring Equipment
- Chemical Injection Quills, Piping & Equipment
- Non-Metallic Sealing Materials & Hard Facing Materials
- Isolation Kits

Corrosion Management

Corrosion management in the oil and gas industry is a critical aspect of ensuring the integrity and longevity of infrastructure, such as pipelines, vessels, and equipment. Given the harsh and corrosive environments inherent in oil and gas operations, effective corrosion management strategies are essential to prevent material degradation, structural failures, and potential environmental hazards. Engineers and corrosion specialists employ a combination of preventative measures, including the use of corrosion-resistant materials, protective coatings, cathodic protection systems, and regular inspection and monitoring programs. These measures not only mitigate the risk of equipment failure but also contribute to operational efficiency and safety. Corrosion management is an ongoing process that requires collaboration between various disciplines, incorporating technological advancements and industry best practices to address the unique challenges posed by corrosive elements in the oil and gas sector.

Benefits of Corrosion Management System:

- Maximizes Life Cycle Costing
- Extent Asset Lifespan
- Enhanced Safety for achieving Operator's LTI (Loss Time Incident) KPIs
- Regulatory Compliance
- Operational Reliability minimizing downtime and production losses

Similarly, in the refining industry, where processing units handle corrosive chemicals and operate at elevated temperatures, corrosion poses a significant threat to equipment integrity. Refineries implement corrosion management strategies that include the selection of corrosion-resistant materials for equipment construction, the application of protective coatings, and the implementation of corrosion inhibitors. Rigorous inspection programs, often utilizing advanced technologies such as non-destructive testing, help identify corrosion at its early stages, allowing for timely intervention and preventive measures. Corrosion management in both the oil and gas and refining industries is not only vital for asset protection but also for maintaining operational efficiency, minimizing downtime, and ensuring the safety of personnel and the surrounding environment.

Corrosion Management System Framework

The Corrosion Management System Framework provides a structured and holistic approach for industries, particularly in sectors like oil and gas and refining, to systematically address the challenges posed by corrosion. This framework encompasses a range of interrelated components, including material selection, protective coatings, cathodic protection systems, corrosion inhibitors, inspection and monitoring protocols, integrity management assessments, education and training, data analysis, and emergency response planning. By integrating these components, the framework aims to identify, assess, and control corrosion risks at various stages of infrastructure life cycles. It emphasizes preventive measures to mitigate the impact of corrosive forces on critical assets, ensuring the long-term integrity and reliability of equipment and structures. This systematic approach not only reduces the likelihood of unplanned downtime and costly repairs but also enhances safety, environmental compliance, and operational efficiency, aligning with industry best practices and regulatory requirements.

Deliverables & Activities

- Corrosion Management Strategy
- Corrosion Management Plan
- RBI / CRAS Report
- Corrosion Loops Diagrams
- Coating Map
- Corrosion Monitoring Philosophy/Plan
- Cathodic Protection Plan
- Asset Passports
- Inspection Plan
- OSI (On-Stream Inspection) – Isometrics
- Report for Selection & Testing of Corrosion Inhibitors
- Condition Monitoring Locations
- Integrity Operating Windows
- Chemical Injection & Wash Water Locations
- Risk Assessment for Structures
- Corrosion Monitoring Locations & Parameters to Monitor
- Corrosion Management Strategies During Construction
- Corrosion Management Strategies During Commissioning & Decommissioning
- Corrosion Management Dashboard
- Inventory Loop Drawings
- Asset Register

Corrosion Control Document (CCD) / Corrosion Management Plan (CMP)

A corrosion management plan is a comprehensive strategy developed by organizations to prevent, monitor, and mitigate corrosion in their assets, facilities, or infrastructure. The primary goal of such a plan is to ensure the integrity and reliability of materials and structures susceptible to corrosion.

If implemented in its true spirit can save not only CAPEX and OPEX but also can ensure all safety risks at ALARP. CMP defines all protocols which a facility needs in order to ensure smooth operation till its design life and sometimes beyond that. It identifies, categorizes, and quantifies risks associated with each individual component of a plant or facility and accordingly recommends appropriate inspection methodology and risk mitigation measures.

CMP should be implemented right at concept select stage for green field projects and all the way through operations. Nevertheless, it can be implemented at any stage. For brown field projects or plants already in operations CMP becomes very important specially if there is no prior material selection or corrosion study. CMP gives confidence to higher management that plant will keep operating without any safety related or production related incidents.

Key Components of CMP

- Introduction and Background of Project / plant / facility.
- Key components listing Names/ tags (Wellhead, piping, flowlines, trunklines, export pipelines, manifolds, pressure vessels, tanks, and sumps, etc.).
- Listing and analysis of process parameters and fluid composition.
- Corrosion rate calculations (for carbon steel piping/pipelines) to know how much material will corrode per annum – using appropriate corrosion rate modelling.
- Corrosion risk assessment – external and internal (qualitative and semi quantitative).
- Identify and list applicable corrosion damage mechanisms (API 571 and reputed operators standard practices like Aramco, ADNOC, Shell, BP, etc.
- Prepare corrosion loops (segregate equipment subjected to similar corrosive conditions) in the form of color coded diagrams (Process Flow Diagrams / Material Selection Diagrams / Process and Instrument Diagrams.
- Fully Quantitative Risk Based Inspection using E2G API RBI software or equivalent.
- Material selection for new facilities or material selection validation/ review for existing facilities based on latest process parameters and fluid composition.
- Corrosion mitigation or control techniques for all applicable corrosion damage mechanisms.
- Recommendations about material substitution, painting, coating, chemical injection, cathodic protection, and inspection.
- Corrosion Inspection and monitoring requirements with recommended KPIs and inspection frequency (covered in more detail under OSI section).
- Plant integrity operating windows (IOW) – this is a window of operating conditions which influence degradation when outside of a defined range and can be influenced by operation.
- OSI – On Stream Inspection methodology and requirement with listing of equipment and piping/pipeline. Inspection points are marked on isometric level for pipeline and data sheets for equipment with type and frequency of inspection.

Typical International Standards

- API 580/581
- API 571
- API 941
- API 945
- API 14E
- API 510
- API 570
- API 572
- API 574
- API 584
- API 653
- ISO 21457
- ISO 12944
- NACE MR0175 / ISO 15156
- NACE SP0487
- NACE MR0103
- NACE SP0103
- NACE RP0407
- NACE SP0198
- ASME B31.12
- ASME B31.3
- ASME VIII, Div 1 & 2
- DNV OS-F101
- DNVGL RP B401
- DNVGL RP F103
- DNVGL RP F101
- DNVGL-RP-F102
- DNVGL-RP-F116
- DNVGL-ST-F201
- DNVGL-RP-F106

Corrosion Risk Assessment Study (CRAS)

A qualitative Corrosion Risk Assessment Study (CRAS) is a systematic evaluation process that focuses on understanding and characterizing the risk of corrosion within industrial systems based on qualitative factors. In this approach, the assessment involves a detailed analysis of various parameters, including material properties, environmental conditions, and historical corrosion data, without quantifying the specific probabilities or consequences. The qualitative CRAS employs expert judgment, experience, and industry best practices to identify and prioritize potential corrosion risks. By utilizing qualitative descriptors such as low, moderate, or high, the study provides a relative ranking of the identified risks, allowing for targeted mitigation strategies and resource allocation. While not relying on quantitative data, a qualitative CRAS offers valuable insights into the potential vulnerabilities of assets, enabling organizations to make informed decisions and implement preventive measures to manage corrosion risks effectively.

Deliverables & Activities

- Corrosion Loop Diagrams
- Material selection diagrams
- Corrosion Rate calculations
- Risk Assessment Chart/spreadsheet
- CRAS Methodology
- CRAS Report
- Inspection Plan

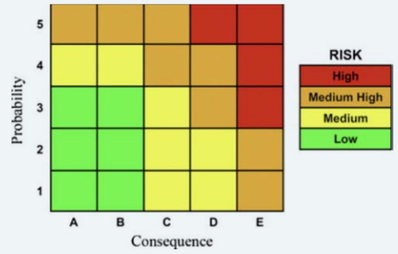
Risk Based Inspection (RBI)

Risk-Based Inspection (RBI) is a systematic approach to asset management that prioritizes inspection efforts based on the level of risk associated with equipment and facilities. Instead of conducting inspections on a fixed schedule, RBI assesses the likelihood and consequences of potential failures, allowing for a more targeted and cost-effective inspection strategy. By combining engineering knowledge, historical data, and risk analysis techniques, RBI helps identify and prioritize areas that require closer scrutiny. This methodology enables organizations to focus resources on high-risk components, optimizing maintenance practices, extending equipment life, and enhancing overall safety and reliability. Ultimately, Risk-Based Inspection provides a proactive and data-driven framework for managing assets, reducing downtime, and ensuring the integrity of critical systems in various industries, including oil and gas, chemical processing, and manufacturing.

The importance of Risk-Based Inspection (RBI) cannot be overstated in industries where the integrity of equipment and facilities is crucial for safety, environmental protection, and operational efficiency. RBI plays a pivotal role in optimizing inspection and maintenance practices by focusing resources on components with the highest risk of failure. This approach not only enhances safety and reliability but also minimizes downtime and associated costs. RBI provides a systematic framework that allows organizations to make informed decisions about when and where to allocate resources for inspections, repairs, or replacements. By integrating engineering expertise, historical data, and risk analysis, RBI enables a proactive and preventive approach to asset management, identifying and addressing potential issues before they escalate. This strategic and data-driven methodology is particularly valuable in industries such as oil and gas, petrochemicals, and manufacturing, where the consequences of equipment failure can be severe. Overall, the adoption of Risk-Based Inspection is instrumental in ensuring the longevity, performance, and safety of critical assets within complex industrial ecosystems.

Deliverables & Activities

- Asset Register
- Inventory Group Drawings
- RBI / CRAS Report
- Corrosion Loops Diagrams
- Coating Map
- Asset Passports
- Inspection Plan
- OSI (On-Stream Inspection) – Isometrics
- Integrity Operating Windows
- EIS (Equipment Inspection Schedule)



On-Stream Inspection (OSI)

On-Stream Inspection (OSI) is a vital component of asset integrity management in industrial settings, allowing for the continuous assessment of equipment and facilities while they are in operation. Unlike traditional inspection methods that require shutdowns, On-Stream Inspection enables real-time monitoring and evaluation of critical components such as pipelines, vessels, and other infrastructure. This approach minimizes production downtime and associated costs, as inspections can be conducted without interrupting ongoing processes. Utilizing advanced technologies such as non-destructive testing, sensors, and monitoring systems, On-Stream Inspection provides valuable insights into the condition of assets, helping identify potential issues, corrosion, or defects. By implementing OSI, industries such as oil and gas, chemical processing, and refining can optimize their maintenance strategies, enhance safety, and prolong the lifespan of equipment. The continuous feedback from On-Stream Inspection facilitates a proactive approach to asset management, allowing for timely interventions and ensuring the reliability and integrity of critical infrastructure throughout its operational life.

Deliverables & Activities

- Inspection Plan
- Asset Passports
- OSI (On-Stream Inspection) – Isometrics
- Condition Monitoring Location Mark-Ups for Piping & Equipment

Key components of On-Stream Inspection

Non-Destructive Testing (NDT): Techniques such as ultrasonic testing, magnetic particle testing, and radiography are employed to assess the integrity of materials and structures without causing damage.

Advanced Sensors: Utilization of sensors and monitoring devices for real-time data collection on parameters such as temperature, pressure, corrosion rates, and structural health.

Remote Inspection Tools: Robotic or remotely operated tools equipped with cameras and sensors to access and inspect hard-to-reach or hazardous areas without human intervention.

Acoustic Monitoring: Using acoustic sensors to detect and analyse sound waves, which can indicate issues such as leaks, corrosion, or other abnormalities within equipment.

Vibration Analysis: Monitoring equipment vibrations to identify potential mechanical issues, misalignments, or imbalances that could lead to failures.

Digital Imaging: High-resolution imaging technologies to capture visual data, aiding in the assessment of surface conditions and identifying potential defects or corrosion.

Corrosion Monitoring Systems: Continuous monitoring of corrosion rates and conditions to predict and prevent corrosion-related failures.

In-Line Inspection (ILI): Deployment of inspection tools within pipelines to assess the internal condition, detect anomalies, and measure wall thickness.

Ultrasonic Thickness Measurement: Portable or automated devices to measure the thickness of material, helping identify areas susceptible to corrosion or wear.

Data Analytics and Software Solutions: Utilization of advanced software tools for data analysis, interpretation, and trend prediction based on the information collected during On-Stream Inspection.

Risk-Based Inspection (RBI): Integration of risk assessment methodologies to prioritize inspection efforts and resources based on the criticality and potential consequences of equipment failures.

Paintings & Coatings

In the oil and gas and refining industry, the selection of appropriate paintings and coatings is critical to ensure the longevity and integrity of infrastructure. As a dedicated consultancy firm specializing in corrosion management, we focus on specifying the most suitable coatings for various applications within these challenging environments.

Our expertise lies in identifying and recommending coatings that offer robust protection against corrosion, chemical exposure, and extreme weather conditions. By thoroughly assessing the unique requirements of each project, we provide comprehensive coating specifications that not only meet industry standards but also align with environmental regulations. Our goal is to guide clients in making informed decisions regarding the selection and application of coatings, optimizing asset protection and minimizing maintenance costs. Collaborate with us to benefit from a tailored approach to coatings that prioritizes performance, durability, and adherence to the stringent demands of the oil and gas and refining sectors.
A comprehensive painting and coating specification must cover information related to surface preparation such as surface cleaning, type of abrasive, anchor pattern, surface preparation category, HSE guidelines, painting / coating products types, thickness of each layer, color code, application method, repair procedure, repair products, proper qualification testing, final inspection and testing requirements with acceptance criteria and a checklist to be filled by coating vendor.

Deliverables & Activities

- Internal Lining Specification
- External Coating Specification
- Coating Specification for Pipelines
- Coating Specification for Field Joints
- Coating Selection Plan
- Riser Coating Specification
- Pipeline Bends Coating Specification.
- Review of painting & coating procedures
- TSA vs organic coating optimizations
- Develop Coating Maps

Welding Engineering

Welding engineering plays a pivotal role in ensuring the structural integrity and reliability of components within the oil and gas and refining industry. In this sector, where the demands on materials and structures are extreme, welding processes are critical for joining metals and creating robust connections.

Welding engineers in the oil and gas industry are tasked with selecting the appropriate welding methods, materials, and techniques that withstand harsh environmental conditions, high-pressure situations, and corrosive elements. The precision and quality of welds are paramount, given the safety and operational implications of welded joints in critical infrastructure such as pipelines, offshore platforms, and refining equipment. Welding engineering also involves adhering to industry codes and standards, conducting rigorous inspections, and implementing advanced welding technologies to ensure the longevity and reliability of welded structures. As a discipline, welding engineering contributes significantly to the overall safety, efficiency, and integrity of operations in the oil and gas and refining sector.

Deliverables & Activities

- Specification for Welding & NDE for Piping
- Specification for Welding & NDE for Pipelines
- Specification for Welding & NDE for Equipment
- Specification for Cladding & Weldoverlay of Piping & Equipment
- Review of WPS
- Fabrication Controls
- Selection of Welding Process
- Post Weld Heat Treatment
- Specification for Mechanically Lined Pipe

Cathodic Protection

Cathodic protection is a critical corrosion mitigation technique employed in the oil and gas and refining industry to safeguard metallic structures, such as pipelines, storage tanks, and offshore platforms, from the corrosive effects of the environment. This electrochemical method involves applying a direct electrical current to the structure, effectively polarizing it and creating a protective environment that inhibits corrosion. There are two primary types of cathodic protection: galvanic and impressed current systems.

Galvanic systems utilize sacrificial anodes, typically made of zinc or aluminum, which corrode sacrificially to protect the connected structure. In contrast, impressed current systems involve the use of external power sources to drive the cathodic protection current, often employing inert anodes. By employing cathodic protection, the industry ensures the extended lifespan and integrity of critical infrastructure, reduces maintenance costs, and minimizes the risk of catastrophic failures caused by corrosion. This method is an integral part of asset integrity management, contributing significantly to the safety, reliability, and efficiency of operations in the oil and gas and refining sectors.

Activities

- Review & vetting of CP system design
- CP system vendor offers review
- Review of technical bid evaluation (TBE)
- Planning for retrofitting anodes
- CP remaining life estimations
- Cathodic Protection for Onshore / Offshore, tanks, pipes, pipelines, structures, hull, vessels, etc.

Deliverables

- Scope of work for cathodic protection system (FEED and EPC)
- Specification for cathodic protection system
- Cathodic protection system design calculation report
- Material Requisition (MR) for cathodic protection system
- Technical Bid Evaluation (TBE) for cathodic protection system
- Materials Take off (MTO) for cathodic protection system
- Cathodic protection system installation and commissioning procedure
- Cathodic protection system installation and commissioning report
- Cathodic protection system audit and inspection report
- Method statement and soil resistivity survey
- Method statement and current drainage survey
- Method statement and Closed Interval Potential (CIP) survey
- Method statement and Alternating Current Voltage Gradient (ACVG) survey
- Method statement and Direct Current Voltage Gradient (DCVG) survey
- Method statement and line location survey
- Method statement and interference test survey
- Cathodic protection system as built drawings
- Cathodic protection system operation and maintenance manual
- Method statement and E log I survey

Asset Integrity Management

Asset integrity management in the oil and gas and refinery industry is a holistic approach aimed at ensuring the reliability, safety, and performance of critical infrastructure throughout its operational life. It encompasses a systematic process of monitoring, inspecting, and maintaining assets to prevent failures, mitigate risks, and comply with industry regulations.

Asset integrity management involves various elements, including risk assessment, corrosion control, inspection strategies, and maintenance planning. By implementing proactive measures such as Risk-Based Inspection (RBI), predictive maintenance, and condition monitoring, organizations can optimize resource allocation, extend the lifespan of equipment, and reduce downtime.

This comprehensive approach not only safeguards against potential hazards but also enhances operational efficiency, reduces environmental impact, and contributes to sustainable practices. In an industry where the consequences of asset failure can be severe, asset integrity management is a crucial framework for maintaining the integrity and reliability of infrastructure in the oil and gas and refinery sectors.

Benefits of an Established Asset Integrity Management System:

- Maximizes Life Cycle Costing
- Extent Asset Lifespan
- Enhanced Safety for achieving Operator's LTI (Loss Time Incident) KPIs
- Regulatory Compliance
- Operational Reliability minimizing downtime and production losses
- Reduces corrective & overall maintenance costs.
- Ensures risks associated with assets are reviewed and actions identified
- Provides Lessons Learnt for better initial design
- Ensures a database is present for historical corrosion and failures.

Deliverables & Activities

- Current Asset Condition Assessment
- Sour Service Assessment (Field Souring)
- Remnant Life Assessment (RLA)
- Fitness for Service Assessment (FFS)
- Life Extension Studies
- ILI Data Analysis
- Historic Corrosion Data Analysis
- Corrosion Data Trends Development
- Pipeline Buckling & Fatigue Study
- ECA Study
- Operating Manuals

Current Asset Condition Assessment & RLA

In the oil and gas and refining industry, a Current Asset Condition Assessment serves as a crucial tool for evaluating the present state of physical assets to ensure operational reliability and safety. This assessment involves a meticulous examination of equipment, pipelines, and infrastructure to identify any signs of corrosion, structural deficiencies, or operational inefficiencies.

Utilizing advanced technologies such as non-destructive testing and visual inspections, the assessment provides real-time insights into the health of critical assets. By proactively identifying and addressing potential issues, organizations in the oil and gas and refining sector can optimize maintenance strategies, minimize the risk of equipment failures, and extend the operational life of assets. This approach aligns with industry standards and regulatory requirements, contributing to the overall integrity and sustainability of facilities operating in challenging environments. A well-executed Current Asset Condition Assessment is a key component of asset management, supporting safe and reliable operations in these dynamic industries.

Deliverables & Activities

- Asset Register
- Review of Facility Inspection Data
- Facility Assessment Report
- Review of ILI & ROV Surveys' Data
- Review of Corrosion Loops
- Remnant Life Assessment (RLA) Report
- Workshops with Clients
- Onshore / Offshore Facilities

Fitness For Service (FFS) and Life Extension Studies

Fitness for Service (FFS) is a comprehensive evaluation process employed in the oil and gas and refining industry to assess the structural integrity and safety of equipment that may have experienced degradation, damage, or other forms of deterioration. This rigorous assessment considers factors such as corrosion, cracks, and material defects, utilizing advanced inspection techniques, engineering calculations, and fitness-for-service codes and standards.

The primary objective is to determine whether a particular component can continue to operate safely, efficiently, and in compliance with industry regulations, or if remedial actions, such as repairs or replacements, are necessary. FFS is particularly critical for managing the integrity of aging assets, as it allows for informed decision-making regarding the continued operation of equipment and helps prevent unplanned downtime. By ensuring that assets are fit for service, organizations in the oil and gas and refining industry can enhance safety, optimize maintenance practices, and extend the operational life of their critical infrastructure. Our FFS assessments are performed in compliance with international standards i.e., ASME & DNV (as applicable).

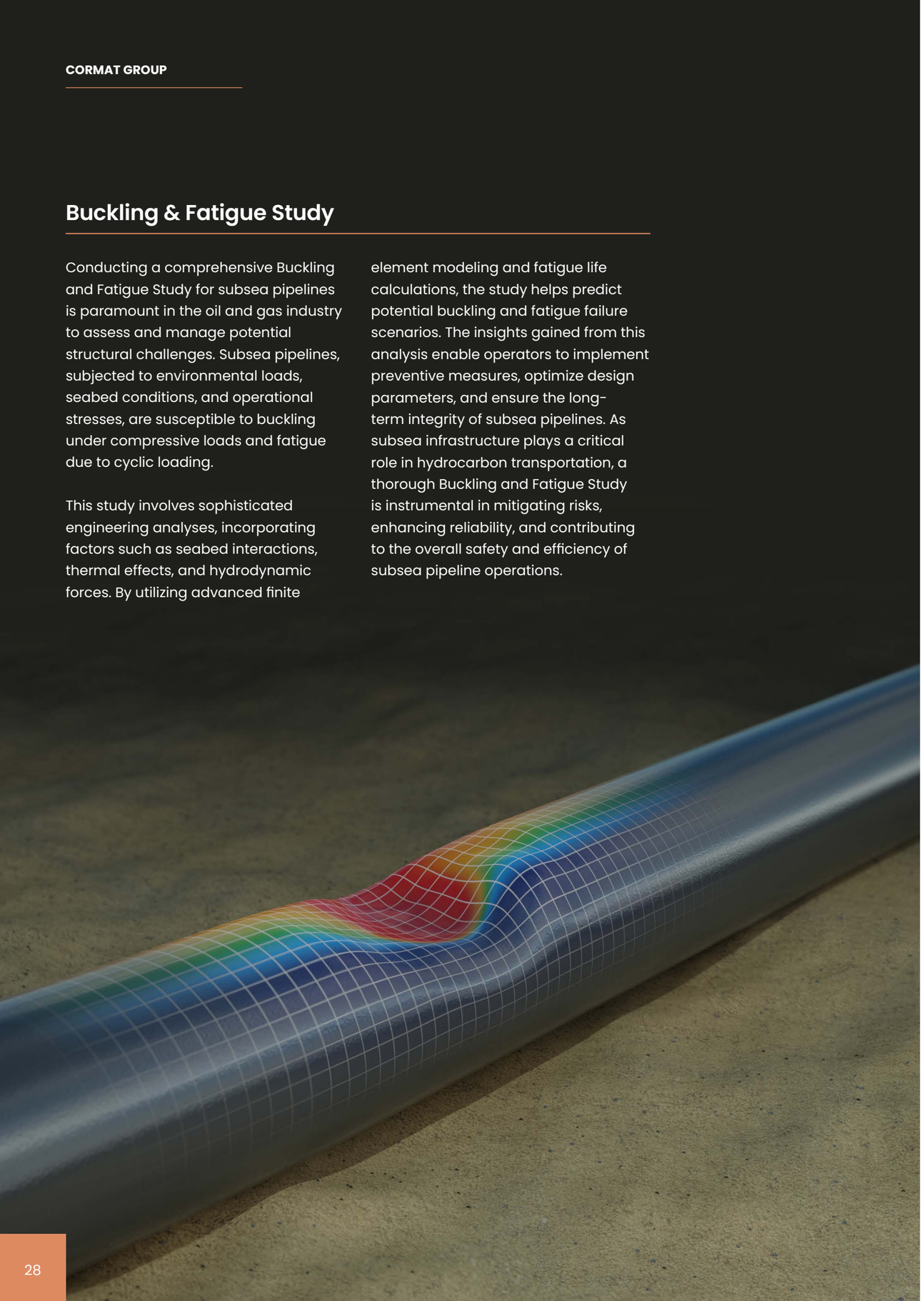
Deliverables & Activities

- FFS Methodology & Data Collection
- Damage mechanisms identification
- Mitigation Plan
- FFS Report
- Remedial Actions Report
- Review of Corrosion Loops
- Life Extension Study Report
- Workshops with Clients
- Onshore / Offshore Facilities

Buckling & Fatigue Study

Conducting a comprehensive Buckling and Fatigue Study for subsea pipelines is paramount in the oil and gas industry to assess and manage potential structural challenges. Subsea pipelines, subjected to environmental loads, seabed conditions, and operational stresses, are susceptible to buckling under compressive loads and fatigue due to cyclic loading.

This study involves sophisticated engineering analyses, incorporating factors such as seabed interactions, thermal effects, and hydrodynamic forces. By utilizing advanced finite element modeling and fatigue life calculations, the study helps predict potential buckling and fatigue failure scenarios. The insights gained from this analysis enable operators to implement preventive measures, optimize design parameters, and ensure the long-term integrity of subsea pipelines. As subsea infrastructure plays a critical role in hydrocarbon transportation, a thorough Buckling and Fatigue Study is instrumental in mitigating risks, enhancing reliability, and contributing to the overall safety and efficiency of subsea pipeline operations.



ECA Study

An Engineering Critical Assessment (ECA) study is a vital process in the oil and gas and refinery industry, specifically focusing on evaluating the structural integrity and fitness for service of critical components such as pressure vessels, pipelines, and other essential equipment.

This study involves a meticulous analysis that incorporates factors like material properties, flaw characterization, loading conditions, and environmental factors. By employing advanced engineering methodologies, including finite element analysis and fracture mechanics, an ECA study aims to assess the potential impact of flaws, cracks, or defects on the structural integrity of the equipment. This proactive approach aids in predicting the likelihood of failure and determining the operational safety margins. By identifying and mitigating potential risks through an ECA study, organizations in the oil and gas and refinery sector can make informed decisions about maintenance, repairs, or replacements, ultimately ensuring the continued reliability and safety of their critical assets.

Deliverables & Activities

- ECA Methodology & Data Collection
- ECA Study Report

Operating Manuals and Procedures

Operating Manuals and procedures are essential documents in the oil and gas and refining industry, providing comprehensive guidance on the proper functioning of facilities. These formal written instructions detail operational protocols, safety measures, performance targets, and the specific roles and responsibilities of personnel involved in plant operations.

Serving as critical tools for plant management, these documents contribute to the efficient and safe operation of complex processes. They play a pivotal role in enhancing production, reducing downtime, and safeguarding both personnel and assets. The development and adherence to these manuals and procedures adhere to industry standards such as ISO 9001:2015 and OSHA 29 CFR 1910.119, ensuring that operations align with globally recognized best practices and regulatory requirements. In an industry where precision, safety, and compliance are paramount, well-crafted operating manuals and procedures are integral to sustaining optimal performance and mitigating operational risks.

Deliverables & Activities

- Standard Operating Manuals
- Standard Operating Procedures

Cormat's Experience

#	Year / Client / Operator & Location	Project Description
1	2023 Worley / ABS / Saudi Aramco Saudi Arabia (Downstream)	**CORROSION MANAGEMENT PROGRAM (CMP) STUDY - FEL-3 (FEED)** **Project: Residue Upgrade Ras Tanura Refinery** Cormat is responsible for the CMP Package as per Saudi Aramco Standards for DBSP Stage and Non-Metallic Study Report. It mainly includes Licensor as well as non-Licensor packages for total 20 plants/units. This involves producing 20 CMP documents in addition to providing support for HAZOP, review of piping documents, etc.
2	2023 Worley / ABS / Saudi Aramco Saudi Arabia (Downstream)	**CORROSION MANAGEMENT PROGRAM (CMP) STUDY - FEL-2 (Revised Pre-FEED)** **Project: Residue Upgrade Ras Tanura Refinery** Cormat is responsible for the CMP Package as per Saudi Aramco Standards for DBSP Stage and Non-Metallic Study Report. It mainly includes Licensor as well as non-Licensor packages for total 25 plants/units.
3	2023 Worley / Red Sea Egypt	**PMC SERVICES (MATERIALS & CORROSION)** **Project: Suez Canal Petrochemicals & Refinery Project - Pre-FEED** Responsible at Pre-FEED stage for reviewing all Vendor/Licensor. This project includes the following units: Crude Distillation Unit (CDU), Naptha Hydrotreater, Naptha Splitter, Continuous Catalytic Reformer (CCR), Aromatics Complex, Diesel Hydrotreater (DHT), Integrated Residue Hydro Processing Unit (IRH), Steam Cracker Unit (SCU), PTA unit, PET Unit, Butene-1, Hexene-1, HPU, SRU, Amine Recovery Unit (ARU) and Sour Water Stripper Unit (SWS).
4	2023 T.EN / BP Offshore Indonesia	**MATERIALS SELECTION STUDY FOR CARBON CAPTURE STORAGE FACILITIES** **Project: UCC Offshore Project - Tanguuh** Responsible for materials selection, corrosion management strategy and project specifications for offshore producing NUI platforms and dense phase CO2 export pipeline, platform and well reinjection flowlines.
5	2022 Genesis / Equinor Offshore Norway	**"MATERIALS SELECTION STUDY FOR CARBON CAPTURE STORAGE FACILITIES** **Project: Northern Lights Tie-Ins Solutions** Responsible for materials selection and corrosion management of dense phase CO2 storage facilities as per Equinor Standards.
6	2022 / 2023 TKJV / NCOC Onshore Kazakhstan	**MATERIALS SELECTION & CORROSION MANAGEMENT STUDY** **Project: Slug Catcher Replacement Study - Pre-FEED and FEED Phases** Responsible for materials selection and corrosion management of new slug catcher including inlet and outlet facilities. Inspection data for existing facilities was also reviewed and assisted client in the development of new pipe class adequate to meet -100°C blowdown temperatures and development of new welding and weldoverlay/clad specification.
7	2022 Wood / ABS / Saudi Aramco Saudi Arabia (Offshore)	**CORROSION MANAGEMENT PROGRAM (CMP) STUDY & CORROSION RISK ASSESSMENT - FEL-3 (FEED)** **Project: Optimisation of Offshore Platforms Standardized Designs** Cormat is responsible for the CMP Package as per Saudi Aramco Standards for FEED Stage and Non-Metallic Study Report. Scope includes oil wellhead platforms, oil tie-in platforms, water injection wellhead platforms, MPFM skids, and subsea pipelines (rigid and flexible).
8	2022 Worley / ABS / Saudi Aramco Saudi Arabia (Offshore)	**CORROSION MANAGEMENT PROGRAM (CMP) STUDY & CORROSION RISK ASSESSMENT - FEL-3 (FEED)** **Project: Safaniyah AH Increment Offshore Oil Production and Water Injection Facilities** Cormat is responsible for the CMP Package as per Saudi Aramco Standards for FEED Stage and Non-Metallic Study Report. Scope includes production wellhead platforms, tie-in platforms and subsea pipelines (rigid and flexible).

#	Year / Client / Operator & Location	Project Description
9	2022 Worley / ABS / Saudi Aramco Saudi Arabia (Offshore)	**CORROSION MANAGEMENT PROGRAM (CMP) STUDY & CORROSION RISK ASSESSMENT - FEL-2 (Concept)** **Project: Safaniyah AH Increment Offshore Oil Production and Water Injection Facilities** Cormat is responsible for the CMP Package as per Saudi Aramco Standards for DBSP Stage and Non-Metallic Study Report. Scope includes production wellhead platforms, tie-in platforms and subsea pipelines (rigid and flexible).
10	2022 Jacobs/ABS, Saudi Aramco Saudi Arabia (Downstream)	**CORROSION MANAGEMENT PROGRAM (CMP) STUDY & CORROSION RISK ASSESSMENT - FEL-3 (FEED)** **Project: Upgrade Sulfur Recovery Units - Yanbu Refinery KSA** SOW includes: - Feed Gas (Acid Gas) - Thermal Stage - Catalytic Stages - Sulfur Degassing - TGTU (Hydrogenation) - Amine Absorbsion - Amine Regeneration - Utilities & Offsites Cormat is resposible for delivering the CMP package including Risk Assessment as per Saudi Aramco Standards.
11	2022 Worley / ABS / Saudi Aramco Saudi Arabia (Downstream)	**CORROSION MANAGEMENT PROGRAM (CMP) STUDY - FEL-2 (Pre-FEED)** **Project: Residue Upgrade Ras Tanura Refinery** Cormat is responsible for the CMP Package as per Saudi Aramco Standards for DBSP Stage and Non-Metallic Study Report. It mainly includes non-Licensor packages. Plants included in this project are as follows. • Acid Gas Recovery Unit • Hydrocracker Unit • Hydrogen Manufacturing Unit • Kerosene Treatment Unit • OSBL Flares • OSBL Offsites & Tankages • OSBL Utilities • SDA / VF • SRU • Sour Water Stripping • Fire Water
12	2022 Fluensys Suriname	**IRON OXIDE DEPOSIT STUDY - OPERATIONAL PHASE** Cormat is responsible for evaluating reasons for regular failures in the steam condensate system for the plant operating in Suriname. Mitigation measures and recommendations provided as per assessment.
13	2022 Worley / ABS / Saudi Aramco Saudi Arabia (Offshore)	**CORROSION MANAGEMENT PROGRAM (CMP) STUDY - FEL-2 (Pre-FEED)** **Project: Safaniya Offshore WER 139 WHP** Cormat is responsible for the CMP Package as per Saudi Aramco Standards for DBSP Stage. Scope mainly includes offshore production platforms, water injection platforms, tie-in platforms, flexible pipelines & rigid pipelines.

#	Year / Client / Operator & Location	Project Description
14	2021 / 2022 Genesis / Shell Norway	**MATERIALS & CORROSION STUDY - FEED** **Project: Shell Linnorm Project - Topsides** Cormat will develop Materials Selection Study Report, Corrosion Management Philosophy, Corrosion Management Framework, Corrosion mitigation and Corrosion monitoring requirements, Topsides Coating Selection Report and Specifications (Coatings, welding, inspections, etc). Scope mainly includes topsides gas/condensate/water treatment, export gas compression, vapour recovery compression, gas dehyration, mercury removal and utilities. Responsible for DEM-1 compliance. Scope includes corrosion management considering NUI concept (Normally Unattended Installation). Managed third party vendor for RBI of equipment and piping and Risk Assessment for offshore structures. Involved in optimisation of materials for structures i.e., Aluminium and GRP. Extensive involvement in optimisation of external corrosion management via TSA coatings and alternate coatings.
15	2021/2022 Genesis / Qatargas Qatar (Offshore)	**Facilities Assessment (FA) & Life Extension (LE) Study** **Project: QG FA&LE Project - Scope 2 - North Asset Pipelines** Responsible for current FA of existing sour gas onshore/offshore/subsea pipelines, pig traps, risers, spools, wyes, etc and risk assessment of whether the pipelines will be fit for service till end of design life. Scope includes life extension and remedial measure required to extend the life up to 2060.
16	2021 Genesis / BP UK North Sea	**Facilities Assessment (FA) Study** **Project: SVT MEOR Package Project** Cormat is responsible for internal and external corrosion assessment of existing facilities i.e., inlet & outlet pipelines to the MEOR package, MEOR Package including mol sieve vessels, puraspec beds, FG system, etc. The scope includes to review existing NDT inspection reports, visual inspection / pictures for external corrosion (coatings, fireproofing, etc) and advise on elemental sulphur production within the pipeline.
17	2021 Jacobs/ABS, Saudi Aramco Saudi Arabia (Downstream)	**CORROSION MANAGEMENT PROGRAM (CMP) STUDY - FEL-2 (PRE-FEED)** **Project: Upgrade Sulfur Recovery Units - Yanbu Refinery KSA** SOW includes: • Feed Gas (Acid Gas) • Thermal Stage • Catalytic Stages • Sulfur Degassing • TGTU (Hydrogenation) • Amine Absorbsion • Amine Regeneration • Utilities & Offsites Cormat is resposible for delivering the CMP package.
18	2021 Schmitec Malaysia / Saudi Aramco Saudi Arabia (Offshore)	**CORROSION MANAGEMENT PROGRAM & CORROSION RISK ASSESSMENT** **Project: Upgrade of Shedgum GOSP Facilities - FEL-3** Scope of work includes HP gas transfer line from SHGOSP-5 to SHGOSP-1, as well as an HP gas compression train at SHGOSP-1 to compress the lower pressure gas to Shedgum Gas Plant. The scope also includes one additional Saltwater Disposal Pump each at SHGOSP-5 and GOSP-6 and upgrading the capacity of the Water-Oil Separators at SHGOSPs 4 and GOSP 5 to handle the additional water cut. Cormat will develop Materials Selection Diagrams, Corrosion Loop Diagrams, Materials Selection Philosophy, damage mechanisms narratives, Corrosion Risk Assessment, corrosion mitigation and corrosion monitoring requirements, Integrity Operating Windows and On-stream inspection and a detailed CMP Report.

#	Year / Client / Operator & Location	Project Description
19	2021 Genesis / Qatar Gas Qatar (Offshore)	**Facilities Assessment (FA) & Life Extension (LE) Study** **Project: QG FA&LE Project - Scope 2 - South Asset Pipelines** Responsible for current FA of existing sour gas onshore/offshore/subsea pipelines, pig traps, risers, spools, wyes, etc and risk assessment of whether the pipelines will be fit for service till end of design life. Scope includes life extension and remedial measure required to extend the life up to 2060.
20	2021 Schmitec Malaysia / Saudi Aramco Saudi Arabia (Offshore)	**CORROSION MANAGEMENT PROGRAM & CORROSION RISK ASSESSMENT** **Project: Upgrade of AM Platforms"" at Zuluf (FEL-3)** Scope of work includes upgrade of • 10 WHPs with subsea pumps, corrosion inhibitors skids, zero flaring lines • Replace existing WHPs with new 09 Slip Over Platforms • Upgrade 02 WHP platforms (from 16 PDM WHPs) • Upgrade ZTP-3, 5 & 7 Tie-in Platforms • 11 New pipelines (6 rigid and 5 flexible) • 22 new risers. Cormat will develop Materials Selection Diagrams, Corrosion Loop Diagrams, Materials Selection Philosophy, damage mechanisms narratives, Corrosion Risk Assessment, corrosion mitigation and corrosion monitoring requirements, Integrity Operating Windows and On-stream inspection and a detailed CMP Report.
21	2021 Genesis / T.EN / Qatar Gas Qatar (Offshore)	**MATERIALS SELECTION STUDY - PHASE 1** **Project: NFPS Compression Project** SOW includes Subsea FG Pipelines (ring main), Risers, Subsea Skids, Spur Lines, pig traps, etc. Scope includes corrosion study report, philosophy documents, corrosion control documents, specifications for coatings (pipeline-subsea, riser splash zone, etc) and specialist review of linepipe specs, cladding specs, hot induction bends, etc.
22	2020 Genesis / DNO-Var Energi Norwegian North Sea	**MATERIALS CONSULTANCY SERVICES** **Project: Brasse Subsea Field Development Project** SOW includes Materials Selection of subsea pipelines for Brasse Subsea Field Development. Operator: Equinor
23	2020 MOL Makori-03, CPF	**MATERIALS SELECTION STUDY** **Project: CPF/GPF PW Transfer Setup upgradation_ For Conversion of MAKORI-03 to Water Disposal Well (WDW)** Materials selection study for Produced Water System including above ground and below ground piping, valves, pipeline, pumps, etc. Produced water production at Central Processing Facility has increased over time. Therefore, the project objective is to upgrade existing PW transfer setup for additional disposal wells. Scope included materials selection, risk assessment, review of existing materials and inspection data, advice on life cycle costing, etc.
24	2020 Worley / ADNOC UAE	**MATERIALS SELECTION STUDY** **Project: Ruwais Sulphur Handling Terminal - 1** SOW includes materials selection philosophy, materials selection report and materials selection diagrams for the RSHT-1 Project.

#	Year / Client / Operator & Location	Project Description
25	2020 Genesis / Enauta Energia Offshore Brazil	**MATERIALS FAILURE STUDY, RISK ASSESSMENT & CORROSION INHIBITOR TESTING** **Project: Petrojarl-1 FPSO Project** SOW includes assisting Genesis with the materials failure study, risk assessment and corrosion inhibitor testing for Inlet Heater Tubes on the Petrojarl-1 FPSO Project located offshore Brazil. 4 Corrosion inhibitors along with demulsifiers were tested in third party laboratory. The results were assessed and associated risks were advised.
26	2020 Genesis / Chryosar North Irish Sea	**MATERIALS CONSULTANCY SERVICES** **Project: Darwen Concept Selection & Optimisation** SOW includes materials selection of subsea pipelines & facilities for the Darwen Concept Selection & Optimisation Study.
27	2020 Schmitec Malaysia / Saudi Aramco Saudi Arabia	**RISK BASED INSPECTION FOR BERRI DEVELOPMENT** **Project: Berri Development (Onshore Flowlines & Tie-ins) Project** SOW includes RBI for equipment, piping & PRD for the Berri Development Project - Onshore.
28	2020 Schmitec Malaysia / Saudi Aramco Saudi Arabia	**CORROSION MANAGEMENT PROGRAM & CORROSION RISK ASSESSMENT** **Project: Upgrade of Shedgum GOSP Facilities - FEL-2** Scope of work includes HP gas transfer line from SHGOSP-5 to SHGOSP-1, as well as an HP gas compression train at SHGOSP-1 to compress the lower pressure gas to Shedgum Gas Plant. The scope also includes one additional Saltwater Disposal Pump each at SHGOSP-5 and GOSP-6 and upgrading the capacity of the Water-Oil Separators at SHGOSPs 4 and GOSP 5 to handle the additional water cut. Cormat will develop Materials Selection Diagrams, Corrosion Loop Diagrams, Materials Selection Philosophy, damage mechanisms narratives, Corrosion Risk Assessment, corrosion mitigation and corrosion monitoring requirements, Integrity Operating Windows and On-stream inspection and a detailed CMP Report.
29	2020 Genesis Oil & Gas / Exxon West Qurna-1, Iraq	**Materials & Corrosion Audit (MCA)** **Project: Produced Water Treatment Package-2** Scope of work includes materials validation and audit of Materials of construction, coatings and corrosion control methods for Produced Water Treatment Package-2 at West Qurna-1, Iraq. The package includes Water De-Sander & Common Solids Accumulator, Oil Recovery System and Treated Water & Backwash Water System. The purpose of the Produced Water Pacakges is to provide facilities for handling and treating effluent water generated in Degassing Stations (DS6, DS7 and DS8). The overall objective is to ensure produced water has no impact on oil production and increase in availability of water suitable for high pressure re-injection in to the reservoir.
30	2020 Schmitec Malaysia / Saudi Aramco Saudi Arabia	**CORROSION MANAGEMENT PROGRAM & CORROSION RISK ASSESSMENT** **Project: Upgrade of AM Platforms at Zuluf (FEL-2)** Scope of work includes upgrade of • 10 WHPs with subsea pumps, corrosion inhibitors skids, zero flaring lines • Replace existing WHPs with new 09 Slip Over Platforms • Upgrade 02 WHP platforms (from 16 PDM WHPs) • Upgrade ZTP-3, 5 & 7 Tie-in Platforms • 11 New pipelines (6 rigid and 5 flexible) • 22 new risers. Cormat will develop Materials Selection Diagrams, Corrosion Loop Diagrams, Materials Selection Philosophy, damage mechanisms narratives, Corrosion Risk Assessment, corrosion mitigation and corrosion monitoring requirements, Integrity Operating Windows and On-stream inspection and a detailed CMP Report.

#	Year / Client / Operator & Location	Project Description
31	2020 Schmitec Malaysia / Saudi Aramco Saudi Arabia	**CORROSION MANAGEMENT PROGRAM & CORROSION RISK ASSESSMENT – FEL3 (FEED)** **Project: Steam Turbine Generator Unit at Shedgum Gas Plant** Scope of work includes Steam Turbine Generator and associated Auxiliaries, Air Cooled Condenser and associated Auxiliaries, Air Removal System and associated Auxiliaries, One Condensate Receiver, Condensate Pumps, Instrument Air Compressor, Instrument Air Dryers, De-superheater, and Pressure Reducing Station. Cormat developed Materials Selection Diagrams, Corrosion Loop Diagrams, Materials Selection Philosophy, damage mechanisms narratives, Corrosion Risk Assessment, corrosion mitigation and corrosion monitoring requirements, Integrity Operating Windows and On-stream inspection and a detailed CMP Report.
32	2020 Schmitec Malaysia / Saudi Aramco Saudi Arabia	**CORROSION MANAGEMENT PROGRAM & CORROSION RISK ASSESSMENT – FEL3 (FEED)** **Project: Dew Point Control Unit (DPCU) – Abqaiq Plants** The project scope includes installing a new Dew Point Control Unit consisting of gas-gas exchangers, propane chillers, cold separator and Deethanizer system at Abqaiq NGL Plants to remove heavy hydrocarbons from Abqaiq Plants and GOPS-5 gases and demolish existing undersized dew point unit. Base scope also includes upgrading TEG dehydration system, installing new condensate stripper system, replacing export gas compression, in-plant piping looping, new flare system as well as a new pipeline to transport HP gas from Abqaiq GOSP-5 to Abqaiq Plants. FEED (Project proposal) stage CMP (Corrosion Management Program) package for Saudi Aramco ABQAIQ facilities. Cormat will develop Materials Selection Diagrams, Corrosion Loop Diagrams, Materials Selection Philosophy, damage mechanisms narratives, Corrosion Risk Assessment, corrosion mitigation and corrosion monitoring requirements, Integrity Operating Windows and On-stream inspection.
33	2020 TechnipFMC / BP Mauritania & Senegal (Offshore)	**MATERIALS SELECTION & CORROSION CONTROL STUDY – EPC (DETAILED DESIGN)** **Project: Tortue FPSO Project** Scope includes: Preparation of two Materials Selection Reports (CMP format i.e., corrosion loops & diagrams, corrosion monitoring per loop, chemicail injection, damage mechanisms assessment, etc) for Process & Utilities, Review of Vendor Packages, Galvanic Corrosion Management for the FPSO, Identifying SMOL for SS316L equipment and piping operating outside NACE MR0175 / ISO 15156 limits using BP's MatSel database and experience and Review of IFE (third party) report to analyse the impact of Organic Acids & Salts accumulation due to MEG Regeneration Cycles.
34	2020 AMCORP GASCO Joint Venture / Karachi Shipyard & Engineering works (KS&EW) Karachi / Pakistan	**MATERIALS SELECTION STUDY & CORROSION ASSESSMENT FOR UTILITIES – EPC** **Project: Design, Install and Commission of Mechanical & electrical Systems and Associated Civil Works for SL&TS on Design-Build Basis at KS&EW** KS&EW intends to install six mechanical systems comprising of Compressed air system, Natural gas system, Oxygen system, cooling water system, Fresh water system and firefighting water system for repair stations of ships located inside Karachi Shipyard facility. Cormat scope includes to perform corrosion assessment and prepare a material selection adequacy check report highlighting materials optimization recommendations. Scope also includes review of non-deliverables; PMS, P&IDs, Data sheets and specification and technical queries related to material and corrosion.

#	Year / Client / Operator & Location	Project Description
35	2020 Schmitec Malaysia / Saudi Aramco Saudi Arabia	**RISK BASED INSPECTION (RBI) STUDY – EPC** **Project: Quantitative Risk Based Inspection Study – Sour Water Strippers And Disposal System** As part of detailed design for Saudi Aramco Berri Gas Plant facilities. The project scope includes sour water collection, processing and disposal. Facilities include 3 phase separators, Stabilization Tanks, Ammonia and H2S strippers, Closed drain, open drains (hazardous and non-hazardous) and utilities. Scope includes fully quantitative RBI study using API E2G software and develop a comprehensive inspection plan based on RBI study results.
36	2020 Schmitec Malaysia / Saudi Aramco Saudi Arabia	**CORROSION MANAGEMENT PROGRAM & RISK ASSESSMENT – EPC** **Project: Water Treatment System Refurbishment at Safaniyah** Detailed design CMP (Corrosion Management Program) package for Saudi Aramco Safaniyah plant. It includes 3 new CPIs to replace 4 existing Water Oil Separators (WOSEP) in Utilities Plant G26; total of 9 new FW draw-off pumps to replace the service of 12 existing FW draw-off pumps; 1 new sludge tank for the new CPIs; 1 new recovered oil surge drum to serve new and existing CPIs and DGFs; and 3 covered oil pumps (2 operating and 1 stand-by). The new recovered oil surge drum collects skimmed oil from 3 new CPIs, 3 existing CPIs and 5 DGFs. CMP Scope is to verify material selection validation, identify corrosion damage mechanism, corrosion loops preparation, IOW, CMP dash board and inspection plan.
37	2020 Genesis Oil & Gas / Centrica UK	**MATERIALS SELECTION FEASIBILITY STUDY** **Project: Skye** Responsible for materials evaluation of new facilities and existing pipeline. Detailed corrosion as-sessment was performed to define potential corrosion rates and damage mechanisms.
38	2020 Schmitec Malaysia / Saudi Aramco Turkmenistan	**CORROSION MANAGEMENT PROGRAM & P-RBI– EPC** **Project: Garagol Deniz West Development Project (GDW)** Detailed design CMP (Corrosion Management Program) package for Petronas Carigali (Turkmenistan) SDN BHD. It includes preparing a CMP & PRBI Report (integrated with Inspection Plan) for the Revised Process Scheme (RPS) of the GDW Platform. CMP scope includes Materials Selection Verification, corrosion monitoring program, Corrosion Loops, Damage Mechanisms and recommendations for inspection based on RBI output, etc.
39	2020 Genesis Oil & Gas / TCO Kazakhstan	**MATERIALS SELECTION STUDY ONSHORE - Gas/LPG Plant** **Project: KLPE/TCO Gas Separation Project** Concept stage - Consultancy services for Materials Selection, Corrosion Control, Corrosion Monitoring, Sour Service Management, and Materials Selection Report. Sour Gas from TCO existing facility is separated into Lean Gas, Ethane Product, LPG and Butane+ product.
40	2020 Schmitec Malaysia / Saudi Aramco Saudi Arabia	**CORROSION MANAGEMENT PROGRAM & CORROSION RISK ASSESSMENT – EPC** **Project: Upgrade Desalinated Water Treatment Plant at Safaniyah** Detailed design CMP (Corrosion Management Program) package for Saudi Aramco Desalinated Water Treatment Plant at Safaniyah. The scope includes Drum Screen, Static Mixers, Roughing Filters, Fine Filters, Feed Water Surge Tank, Backwash Pump, Catridge Filter Water Pump, CIP Tank and Piping, Deaearator Unit, Wash Water Tank and Pumps, Utility and Potable Water Tank and Pumps. CMP scope includes Materials Selection Verification, corrosion monitoring program, Corrosion Loops, Damage Mechanisms and recommendations for inspection based on RBI output, etc.

#	Year / Client / Operator & Location	Project Description
41	2020 Schmitec Malaysia / Saudi Aramco Saudi Arabia	**CORROSION MANAGEMENT PROGRAM & RBI – EPC** **Project: Sour Water Stripper (SWS) and Disposal System** Detailed design CMP (Corrosion Management Program) package for Saudi Aramco Berri Gas Plant facilities. The scope includes sour water collection, processing and disposal. Facilities include 3 phase separators, Stabilization Tanks, Ammonia and H2S strippers, Closed drain and utilities. CMP scope includes validation of materials selection, corrosion monitoring programme, Corrosion Loops, damage mechanisms and recommendations for inspection based on RBI output.
42	2020 Schmitec Malaysia / Saudi Aramco Saudi Arabia	**CORROSION MANAGEMENT PROGRAM & CORROSION RISK ASSESSMENT – FEL2** **Project: Refined Product Pipeline from Qassim Plant to Jawf Facilities** Concept stage CMP (Corrosion Management Program) package for Saudi Aramco QASSIM _ JAWF facilities. The scope includes to collect, store and transport refined products (diesel, high octane fuel) from Qassim plant to Jawf via pipeline. Facilities include Storage Tanks, Pumps, Pipeline, Drains and Flares. CMP includes validation of materials selection, corrosion monitoring programme, recommendations for inspection based on RBI output, etc.
43	2019 TechnipFMC / BP Mauritania & Sengal (Offshore)	**OFFSHORE - FPSO - Gas Plant, Sour** **Project: BP Tortue FPSO - FEED** Consultancy services for Materials Selection, Corrosion Control, Corrosion Monitoring, Sour Service Management, Specifications and Reports. Sour Gas is treated in the FPSO to produce LNG.
44	2019 TechnipFMC / ADNOC Abu Dhabi	**ONSHORE / OFFSHORE – Gas / Condensate Plant, Sour** **Project: Umm Shaif Gas Field Development - FEED** Consultancy services for Materials Selection, Corrosion Control, Corrosion Monitoring, Sour Service Management, Specifications and Reports. Scope also included representing TechnipFMC as PMC for CRAS Study performed by Third Party. Sour Gas is treated in the plant to produce export gas and the condensate and sour water are treated in their respective stripping units. Responsible for dealing with vendor (Larkton) for CRAS Study.
45	2019 TechnipFMC / TOTAL Oman	**ONSHORE - LNG Plant, Sour** **Project: SOHAR LNG Bunkering - FEED** Consultancy services as Lead Engineer / Management Support for Materials Selection, Corrosion Control, Corrosion Monitoring, Sour Service Management, Insulation, Coatings, Pipelines Coatings, Specifications and Reports. Sour Gas is treated to produce LNG.
46	2019 Gasco Engineering / POGC Polish Oil and Gas Company Poland / Pakistan	**ONSHORE – Gas Sweetening Plant, Sour Project: 40 MMSCFD Gas Sweetening Unit - EPC** Material selection and corrosion control study. Corrosion monitoring recommendations, materials selection report, materials selection diagrams, technical note for sour service management.

YOUR PARTNER IN MATERIALS AND CORROSION ENGINEERING SOLUTIONS

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