

# ENERGY GOSTAR ROYAN ENGINEERING COMPANY


FROM 2013



## WHO WE ARE? CORROSION SPECIALISTS?

Our goal is to be the first metallurgical company in Iran.  
Why should we select EGR for metallurgical consulting and analysis?  
Do you use any consultants?  
Where did you start?





**CORROSION  
IS COMPLEX  
IF IT WAS  
EASY  
ANYONE  
COULD  
SOLVE  
(AND STOP IT)!**

## **EGR SERVICES & CAPABILITIES**

Professional Corrosion Assessment & Control Services

Failure Analysis Services

Corrosion Management-Integrity & Risk Based Inspection Services

Refinery Metallurgy & Integrity Management

Corrosion Analysis & Consulting

Coating Options-Design & Failure Analysis

Turnkey Metallurgical Solutions

Forensic Investigation Services

Welding Consulting & Failure Analysis Services

NDE Analysis

Material Consulting & Corrosion Analysis Services

Procurement Services

Material Supply (Monitoring Devices & Piping Materials)

Cathodic Protection- Assessment & Design

Site Supervision

Metallurgical Forensic Analysis For Insurance

Training Courses



## PROFESSIONAL CORROSION ASSESSMENT & CONTROL SERVICES

When corrosion occurs, you want consultants that understand your problems and are skilled at finding appropriate resolutions. We aim to provide improved insights into the real-world corrosion of materials to help improve your quality and operations. Some examples of our corrosion consulting include:

- Corrosion Failure Analysis
- In-Field Corrosion Monitoring
- Corrosion Coupon Installation and Assessment
- Sour Service Consulting and Analysis
- Material Selection & Characterization
- Corrosion Control & Management Consulting
- Microbiological Corrosion Analysis
- Pipeline Internal Corrosion Direct Assessment (ICDA)
- Pipeline External Corrosion Direct Assessment (ECDA)
- Site Supervision

## FAILURE ANALYSIS SERVICES

When failures occur, you need accurate and reliable answers that are delivered fast. Our metallurgical failure analysis experts have the skills to quickly find the problem and prevent it from recurring. We offer world-class service combined with attention to scientific detail and your needs and with 100's of failures analyzed, we have the experience to help you find the most relevant and cost-effective failure solutions:

- Pipelines leaks, Ruptures, and Incident Investigation
- Storage Tank Failure Analysis
- Corrosion Failure Analysis
- Welding Failure Analysis
- Fire Damage Assessment
- Offshore Structures Failure Assessment
- Drilling Operations – Casing, Tubing, Tools, and Components
- Failure Analysis of Pumps, Valves, and Fittings
- Failure Analysis of Impellers and Components
- and Many other Components



## CORROSION MANAGEMENT, INTEGRITY & RISK BASED INSPECTION SERVICES

Corrosion Management and Control are two core activities for maintaining asset integrity, reliability and safety. These activities provide the basis for effective monitoring and mitigation of the destructive corrosion process over the life cycle of an asset. However, the measures and processes put in place need to be practical and achievable. EGR offers a suite of activities designed to intervene and mitigate the negative causes and impact of corrosion during PRE-FEED, FEED, Design, Fabrication, Operation, and Decommissioning Stages, such as:

- Assessing Corrosion Rates and Defining the Requirement for Inhibition, Internal Protection or the Selection of CRAs
- Materials Engineering Services
- Corrosion Studies
- Corrosion Risk Assessments and Planning
- Chemical Testing Programs and Recommendations
- Independent Management of Laboratory Testing and Coupon Removal/analysis
- Cathodic Protection Assessment
- Periodic Analysis and Reporting of Corrosion Management Systems
- Documentation of Asset's Inspection and Monitoring Records
- Creation of More Effectively Correlation Between Related Sections and Shared Analysis of Processes & Procedures
- Performance Analysis of Methods used for Corrosion Monitoring
- Performance Analysis of Chemicals & Optimization of Chemical Injection Programs
- Identification of Defects and Anomalies
- Design and Optimization of Inspection Programs
- Corrosion Failure Controls & Leaks Elimination
- Provision of Corrosion Control Solutions
- and finally Increasing of Safety & Health of Environment



## REFINERY METALLURGY & INTEGRITY MANAGEMENT

For compliance with codes and regulatory requirements, EGR offers metallurgical services including traditional and advanced nondestructive testing analysis, mechanical integrity assessments, and/or fitness-for-service programs. We can work in the chemical processing industry on a daily basis for inspection of piping, tubing, pressure vessels, tanks, and other plant equipment:

### **Specific services offered include:**

- Metallurgical Consulting
- Failure Analysis
- Corrosion Analysis
- Maintenance Planning, Consulting, and Inspection
- Risk-Based Integrity (RBI) Programs
- Computer Aided Drafting (CAD) Software and Modelling

Our metallurgical consulting team, supported by our data management system and inspection teams are available for rapid support and service when you need answers fast.

### **EGR performs services for:**

- Piping Inspection According to API 570
- Paint and Coating Inspection According to NACE Practices
- Welding Procedure Development and Qualification
- Weld Inspection by AWS Certified Inspectors
- Piping, Tubing, and Pressure Vessels, according to API 510 and Other Specifications
- Tanks and Structural Steel Inspection According to API 653
- Welded Joint inspection for Refinery Inspection Testing
- Heat Exchanger Inspection
- Pressure Vessels and Pressurized Equipment Inspection
- Insulation Inspection



## CORROSION ANALYSIS & CONSULTING

We bring years of experience (and our passion) to the fight against corrosion, to help identify and solve your challenges. EGR is capable of analyzing many forms of corrosion through standard ASTM & NACE testing and many customized corrosion testing practices and our team of corrosion scientists has worked on every major form of corrosion:

- Assessing corrosion rates and defining the requirements for inhibition, internal protection or the selection of corrosion resistant alloys.
- Corrosion mechanisms – galvanic, crevice, pitting, preferential weldment corrosion, corrosion fatigue, inter / intragranular, SCC, SSC and HPIC, SOHIC, MIC.
- Specialist materials testing for sour service (HISC, SOHIC, HE, SSCC and the full ring test), including sour service requirements for plastically strained line pipe.
- Corrosion rates in CO<sub>2</sub> containing environments, using programs such as deWaard/Milliams, Norsok and Electronic Corrosion Engineer.
- Materials susceptibility to H<sub>2</sub>S bearing hydrocarbon service using NACE MR 0175 and EFC 16.
- Corrosion theory, anodic/cathodic reactions, polarization diagrams, Evans diagram, principles of cathodic protection, over potentials, galvanic series/couples.
- Cause and effects of corrosion.
- Causes of failure to pipelines, risers and subsea equipment.
- Internal and external corrosion mechanisms on pipelines, subsea structures/components, topsides components, piping.
- Hydrate prevention (methanol), dehydration systems (MEG/TEG) and dew point control.



## COATING OPTIONS- DESIGN & FAILURE ANALYSIS

The EGR provides a comprehensive overview of the state-of-the-art in the fields of industrial coatings, advanced extreme coatings, surface treatment, linings and interfaces engineering, discusses recent advances and current problems, and points out the prospective development of the field, these would typically include the following activities:

- Various Industrial Coatings, Limitations & Challenges
- External Coating for Oil & Gas Pipelines, Water Pipelines
- External & Internal Field Joint Coatings
- External Coating challenges for City Gas Distribution
- Internal Coatings – Flow Assurance Coating
- Internal Coatings- Anti Corrosive Linings
- Coatings for Plant Piping and Above Ground Storage
- Rehabilitation Coatings
- Surface Preparation, Assessment & Best Practices of Coating Application
- Organic, Inorganic & Metallic Coatings Systems
- Cryogenic, High Temperature & Composite Coating
- Advanced & High Performance Coating Systems
- Quality Control, Testing, Evaluation & Inspection Techniques
- Coating Failures, Repair/ Rehabilitation and Maintenance
- Surface Engineering, Nano Technology, Plasma, Laser Techniques
- Thermal Spray, Galvanizing Applications & Development
- Refinery, Petrochemicals, Gas Processing Coatings
- Pipeline (Internal/ External) Coating, Offshore & Marine Structures
- Chemical & Process Industries, Fertilizer, Power & Energy Sector
- Concrete Coatings, Infrastructure
- Inspection & Study of Coatings Including Design & Failure Analysis



It all starts with metallurgical expertise. Our senior metallurgists have all been trained in turnkey metallurgical analysis, corrosion assessment, and welding consulting:

### **TURNKEY METALLURGICAL SOLUTIONS**

- Risk-Based Inspection and Fitness-For-Service
- Materials Selection
- Metallurgical R&D
- Expert Failure Analysis
- Photographic Documentation
- Metallography
- Microstructure Analysis
- Mechanical Properties
- Hardness and Microhardness
- Hydrogen Damages Analysis – Gaseous and Electrochemical Hydrogen Services

### **NDE ANALYSIS**

- Brinnell Hardness
- Dye Penetrant
- Magnetic Particle
- Fluorescent Particle
- Weld Inspection, Testing, and Qualification
- Weld Procedure Qualification
- Weld Visual Inspection
- Weld Hardness Test
- Weld Macroetch Test
- Nick Break Test
- Ultrasonic (Thickness Testing only)

### **FORENSIC INVESTIGATION SERVICES**

- Corrosion Assessment
- Microscopic Assessment
- Fractography
- Mechanical Properties Determination
- Fitness-for-Service Assessment
- NDE and Inspection Services
- Root Cause Determination
- Expert Witness Testimony

### **WELDING CONSULTING & FAILURE ANALYSIS**

- Welding Consulting and Evaluation
- Weld Failure Analysis
- Welding R&D





## MATERIAL CONSULTING & CORROSION ANALYSIS SERVICES

EGR Materials Consultants is focused on advancing materials solutions to accommodate the more severe service conditions including, ultra deep-water applications, arctic service, HP/HT systems, sour gas, and environments containing high levels of CO<sub>2</sub>, fatigue and high strain applications. The materials services EGR can provide include:

- Materials Selection Including Corrosion Resistant Alloys, Ferrous And Non-Ferrous Alloys, Resin Based Composites And Elastomers.
- Line Pipe Auditing And Verification Services With A Team Of World Class Experts.
- Extensive Line Pipe Manufacturing Experience, Including; DSAW, Seamless, HFI/ERW, Spiral, Clad (Metallurgically Bonded And Mechanically Lined).
- Specifying Steel Chemistry And Heat Treatment Requirements For Various Applications.
- Forging Material Issues For Buckle Arrestors, J-Lay Collars And Flexjoints.
- Induction Bends (Chemistry, Heat Treatment And Weldability).
- Sour Service Testing Requirements Including: SOHIC, HE, SSCC, Full Ring Test.
- Failure Analysis, Metallography (Including Access To Optical, Scanning And Transmission Electron Microscopy Equipment).
- Corrosion Modelling To Determine Corrosion Allowance Requirements.
- Specifying Material Requirements For Low And High Temperature Applications.
- Coatings Selection For Pipelines, Refineries And Subsea Equipment.

## PROCUREMENT SUPPORT

EGR can provide well qualified and experienced package engineers to oversee procurement support. These would typically include the following activities:

- General
- Interfacing
- Bid Phase
- Manufacturing Phase
- Delivery Phase



## MATERIAL SUPPLY

### A) MONITORING DEVICES

A large number of corrosion monitoring techniques exist. The following list details the most common techniques which are provided by EGR in industrial applications:

- Corrosion Coupons (weight loss measurements)
- Electrical Resistance (ER)
- Linear Polarization Resistance (LPR)
- Galvanic (ZRA)
- Hydrogen Penetration
- Microbial
- Sand/Erosion

Other techniques do exist, but almost all require some expert operation, or otherwise are not sufficiently rugged or adaptable to plant applications.

### B) PIPING MATERIAL - SINGLE SOURCE SUPPLIER OF COMPLETE PIPING PACKAGES

Supply of alloy steel, stainless steel, nickel alloys and carbon steel in all forms and dimensions.

- Our customers: oil & gas sector, the chemical & petrochemical sector and the nuclear industry
- Complete packages including pipes, flanges, fittings, bar, sheet, forgings, gaskets, ...
- Supply of hard to find specials in short lead times
- Professional management of large-scale projects
- Project department: focused on engineering companies
- Direct Sales department: focused on end clients and sub-contractors



## CATHODIC PROTECTION- ASSESSMENT & DESIGN

In order to prevent corrosion from damaging and tearing down valuable assets, cathodic protection systems are installed. We offer many years of experience within cathodic protection and offer various types of solutions:

- CP Modelling
- CP Design
- CP Inspection
- CP Management and Consulting

With EGR, you benefit from:

- Experience with all types of cathodic protection systems
- Experience testing, installing and maintaining cathodic protection systems for all types of structures
- Highly qualified professional and corrosion engineers and technicians
- Team members with experience on the client side of CP projects
- Experience managing CP projects and corrosion departments of utilities and pipeline companies

## SITE SUPERVISION

EGR has certified Corrosion Specialist with extensive experience in providing expert witness and expert testimony in litigation and arbitration cases related to corrosion, materials, metallurgy, paints & metallic coatings. We have acted in the capacity of corrosion expert, expert metallurgist, electrochemistry expert and materials expert in the high court, the subordinate court and the international arbitration center. With internationally recognized professional certification and professional registration, we provide expert witness and litigation support to your cases both locally and internationally.



## METALLURGICAL FORENSIC ANALYSIS FOR INSURANCE

EGR provides metallurgical forensic analysis and failure analysis for insurance-related claims and cases. We regularly work with all sides, including customers, insurers, and even regulatory bodies, and will work hard to help you determine the root cause.

- Our experts have experience in failure analysis of a wide range of metals and materials.
- We typically will perform a thorough analysis to determine the root cause of failure.
- Just as importantly, we then provide clear communication that helps you explain your cases to laypeople, judges, and engineers alike.
- In most cases our metallurgical analysis results in settlements, saving all sides time and money.

### **What if I need a metallurgical expert witness for an insurance case that is likely to go to court?**

Our PhD expert witnesses have impressive credentials including degrees from first class universities. We have produced publications in areas including corrosion and our roster of consulting metallurgists includes some of the world's leading metallurgical minds with impeccable credentials. We provide clear and powerful testimony when needed in expert witness cases, and back that testimony up with high-quality graphics, animations, and presentations to make our failure analysis results crystal clear.



## TRAINING COURSES

EGR is activated in Iran as a training provider. EGR has Certified Corrosion Specialist providing customized in-house training, on-site training, online and distance learning courses on corrosion, materials, metallurgy, paints and metallic coatings. Our corrosion courses are developed and taught by Certified Corrosion Specialist with over 15 years of practical experience in the field. The following short courses have been conducted regularly since 2013 and were accredited by the professional engineers. We do not compete on course fees but on unparalleled course quality and learning support. The following corrosion short courses are relevant to materials selection & materials analysis. They can be conducted at any time for you as in-house training, online or distance-learning courses.

### A) Corrosion Training Courses Related to Materials Selection & Materials Analysis:

- Corrosion, Metallurgy, Failure Analysis and Prevention
- Materials Selection and Corrosion
- Corrosion and Its Prevention
- Stainless Steels and Alloys: Why They Resist Corrosion and How They Fail
- Protective Coatings: Inspection, Maintenance and Repair
- Marine Corrosion, Causes and Prevention
- Concrete Corrosion: Causes and Prevention
- A Basic Course in Corrosion Control and Prevention

### B) Corrosion Training Courses Related to Cathodic Protection & Anodic Protection:

- An Advanced Course in Cathodic Protection
- Design and Operation of Pipeline Cathodic Protection Systems
- Design, Installation, Operation, Maintenance, Survey and Monitoring
- Cathodic Protection of Underground Pipelines

Costs of unmanaged corrosion can range from unplanned shutdowns and unbudgeted capital expenditure to full replacement of machinery and equipment. A 2016 corrosion study by NACE International reveals that the cost of corrosion represents about 3.4 percent of a country's gross domestic product (GDP), i.e. approximately US\$2.5 trillion on a global scale.

Retrospectively, a 2002 study conducted by the US Federal Highway Association, estimated a total annual cost of corrosion in the United States to be about 3.1 percent of the country's GDP.

Despite ongoing corrosion research, technological progress in the development of corrosion related inspection, digitalization of monitoring tools and selection of chemicals, the comparison of these two corrosion cost estimates would suggest that no significant progress has been made in reducing the costs associated with corrosion over the last 15 years.

A major contributory factor to failures from corrosion is often a consequence of inadequate intervention linked to corrosion management and/or inspection.

EGR, as a specialist independent corrosion management service provider can offer a client a corrosion management system that complies with Safety, Health and Environmental policies in industries such as Oil and Gas, Power Generation and Nuclear. This helps to reduce leakages and unplanned maintenance, consequently increasing plant reliability and availability.

**WE CAN'T TRANSFORM  
SOUR TO SWEET,  
BUT WE CAN HELP YOU  
TAKE IT WITH A SMILE!**





# CONTACT US



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