One of the major challenges facing petrochemicals and refineries in the region is corrosion, as they operate under tough environmental conditions, in which the different parts of plants are subject to degradation and consequence an unexpected breakdown, which may impact other phases of the production chain. "Corrosion is a degradation process that leads to the reversing of material to its lower energy natural state," says Dr Fikry Barouky, principal corrosion consultant at Anti Corrosion Technology (ACT) Australia.

Corrosion is also defined as the irretrievable deterioration of metals which is caused by an electrochemical reaction with exposure to a specific environment resulting in mass loss, energy dissipation, change of properties, and performance deficiency to stand the service life expectancy. "Some of the reasons behind corrosion can be operation related or can stem from a lack of appropriate engineering practices in the design phase," observes Dr Barouky.

The rate and type of corrosion is influenced by both the external environment and the corrosive impact of the chemicals and products generated within an installation.

"No matter what definition of corrosion we use, the main driving force behind this "

"COMPREHENSIVE CORROSION MONITORING PROGRAM IS ESSENTIAL FOR THE SAFE, AND COST-EFFECTIVE OPERATION OF FACILITIES"

RICHARD RITCHIE, DIRECTOR, SGS INDUSTRIAL SERVICES.
process comes is thermodynamic. The extraction of metals from theirs oxides usually requires application of serious energy treatment,” says Dr. Slawomir Kus, Corrosion Specialist at Honeywell. “Hence, when exposing to different environments, including atmospheric and process, pure metals have natural tendency for lowering their energetic allowance by returning to the oxide state - which leads to metal deterioration and failure,” he adds.

In the Middle East region a large number of process plants are in coastal regions and the humid marine environment can cause external corrosion on metals that are not protected by paint or corrosion protection systems says experts.

Inside the plant, it is another story. “On the interior surface the process fluid may be corrosive. In production processes such as dehydration, CO2 and H2S removal remove the corrosive species from the fluid and the materials of construction is chosen to minimise corrosion; plants are designed with specific fluid chemistry, as plants get older the fluid composition can change,” explains Dr Kirsten Oliver, upstream manager, production and integrity assurance at Intertek.

Corrosion is a major problem in the petrochemical industry, as it is one of the most serious aging mechanisms that impacts equipment in petroleum refineries and chemical processing plants. Uncontrolled corrosion leads to equipment failure, loss of containment, and to potential harm to personnel and the environment.

“In many facilities key equipment such as piping, valves, vessels, vessel internals, condensers, boilers, and heat exchangers may have been in service for decades and have the potential to be compromised even by relatively slow corrosion mechanisms,” says Richard Ritchie, director, international sales asset integrity management at SGS Industrial Services. “That is why a comprehensive and effective Corrosion Monitoring program is essential for the safe, reliable and cost-effective operation of petrochemical facilities,” he adds.

Uncontrolled corrosion can cause leaks and component failures, which reduce the performance and reliability of important equipment. In extreme cases, corrosion can lead to unexpected failures that are often costly, in terms of lost production, the expense of repairs, lost or contaminated products, environmental damage and potential harm to humans. “Corrosion cannot be avoided,” says Dr Barouky. “There is no one solution to mitigate and control corrosion, for example in buried pipelines the well known best practice to prevent corrosion is to use external coating as the primary (first line defense), while the Cathodic Protection can be used as a secondary (second line defense) corrosion protection,” he adds.

Within the refining and petrochemical industries plant operators use several conservative approaches to combat internal corrosion. “It utilizes mainly off-line corrosion monitoring systems; traditional past-data Risk Based Inspection (RBI) procedures, chaotic corrosion monitoring databases without linkage to process variables fluctuations and minor or no usage of corrosion modeling and prediction techniques,” says Dr Kus. “Unfortunately, the corrosion is still a serious threat for unit’s integrity and “no corrosion problems in the past and present” doesn’t mean “no corrosion problems in the future,” he adds.

To avoid unplanned shut downs and the interruption of the production that may cause the company multibillion dollar loses, companies tend to monitor the corrosion. “Having a robust corrosion management system that enables the rate of degradation to be understood, this enables proactive maintenance to be carried out at lower cost that a “panic” and fix it approach,” says Dr Oliver. “We assist clients in developing corrosion management system that are suitable for their facilities, focusing the effort where the risk of failure as a result of corrosion is likely to occur,” she adds.

Today, corrosion can be quantified, mitigated, prevented, and controlled in all the life cycle of every plant from the design phase to the decommissioning. “Every oil and gas operating company should develop and execute a proactive corrosion management program to include engineering material selection, corrosion control and monitoring throughout the life cycle of the plant,” says Dr Barouky. “The Corrosion management program, which should be an integrated part of the strategic framework of any operating company, will continually asses and improve personnel safety, plant reliability, and competent performance to secure uninterrupted production without environmental impact,” he adds.

An effective corrosion monitoring program includes a wide range of activities says Ritchie. “Identification of all critical components; identification of component alloy composition and measurement of the location and extent of corrosion are the main strategies to be followed,” concludes Ritchie.”