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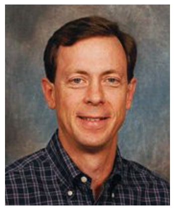

Corrosion monitoring boosts productivity in refineries, plants

It is no wonder that corrosion is viewed as a major challenge in refineries and gas plants around the world. It affects the environment, safety and production efficiency, and the consequences of corrosion can be severe and costly. Plant shutdowns and accidents resulting from corrosive leakages and fractures add up to billions of dollars of unanticipated costs every year in the U.S. alone, according to NACE.

There are many factors that can contribute to corrosion, and they can be difficult to quantify. Corrosion can occur in relatively unexpected areas of a plant and also develop as operating conditions change. Operators taking action to resolve corrosion issues in one plant unit sometimes discover that the "solution" has pushed corrosion to another plant unit. Historically difficult to predict in advance, the causes of corrosion have typically required advanced scientific investigation.

Advanced corrosion monitoring

Today, natural gas plant operators have the option of using non-intrusive, state-of-the-art corrosion monitoring technology in their amine treating units to quickly and efficiently investigate corrosion "fingerprints" within amine circuits — a cost-effective tool that identifies where corrosion is taking place.

As a complement to current asset management programs, some ongoing corrosion monitoring systems are designed to help plant operators identify potential corrosion issues before they become acute and to provide recommendations on system optimization. This helps reduce downtime by allowing operators to know in advance what needs to be addressed and resolve problems associated with corrosion.

Monitoring methods

There are various ways to monitor for corrosion in the amine system of a refinery or gas plant, starting with the use of analytical data. During the analytical examination of a system, information can be gathered on amines, including anions, cations, degradation products, stable salts and amine loading. For example, when high metal levels are detected, these can be a sign of corrosion, depending on the metallurgy involved. Reflux samples, on the other hand, can be analyzed to detect key species such as ammonia and metals.

Another means of monitoring for corrosion is the use of operational data. Depending on the piece of the amine circuit involved, operating parameters can be evaluated to determine the risk for corrosion:

- Velocity should stay within prescribed ranges to avoid corrosion phenomena during monitoring, which is considered in combination with metallurgy. For example, carbon steel piping can experience corrosion by erosion when superficial flow velocities are high.
- Low velocities could lead to under-deposit corrosion. Based on results of salt deposition calculations in regenerator vapor lines, purging may be the appropriate recommendation.
- Finally, on-site field measurements are used to validate and/or identify critical areas suffering from corrosion. This involves physical monitoring to confirm potential corrosion activity.

An ounce of prevention

Isolating and diagnosing issues can help remediate and prevent system corrosion. For example, one supplier audited a gas treating system in Romania in 2017 to determine the possible causes of high corrosion rates and damages. Two identical regenerator units were operating in the refinery, both with high levels of heat-stable amine salts, but only one was experiencing corrosion, while the other one had no issues. After extensive troubleshooting, the primary root cause was found to be amine lean loading. This was determined by using analytical and operational data, sample analysis and field monitoring, as well as physical inspection while the system was on line. A bleed-and-feed remedy was recommended, which involved adding fresh amine to the system while also removing a stream of contaminated amine, followed by operating lean loading at the recommended levels. Recommended preventative actions included discontinuation of the current corrosion inhibitor and a reduction in the use of antifoam. Finally, routine sample analysis of the amine system was recommended to maximize future performance.

Analytical data and computer simulations of an amine system provide reliable indicators of potential risks or issues related to corrosion. Expertise and experience with refineries and gas plants are critical, as well as knowledge of the causes and prevention of corrosion. Effective corrosion monitoring must be tailored to fit system needs, ideally including facility corrosion data going back many years.

Once corrosion monitoring is operational, recommendations can be made on what metallurgy to use in different parts of the system during repairs or capacity extensions to help reduce corrosion rates over time.

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