Predictive Corrosion Management: Visibility and Trending of Interior Piping Wall Loss Enables Better Decisions

A Frost & Sullivan White Paper

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50 Years of Growth, Innovation and Leadership
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INTRODUCTION

According to the 2016 International Measures of Prevention, Application and Economics of Corrosion Technology (IMPACT) study by NACE International, in 2013 corrosion-related failure, downtime, repair, and maintenance was estimated to cost $2.5 trillion globally. This was approximately 3.4% of the global GDP. Frost & Sullivan estimated that, in the oil & gas industry alone, annual corrosion-related costs total at least $200 billion. Frost & Sullivan research found that oil well operators spend almost 25% of their operational expenditure (OPEX) budgets on corrosion inhibitors. The oil & gas industry has realized that periodic corrosion testing is not effective: assets fail faster than what testing can identify. Monitoring is now considered the best option. The NACE International study found that implementing corrosion prevention best practices could save 15-35% of the cost of corrosion-related repair and maintenance.

Crude contaminants such as hydrogen sulfide, hydrochloric acid, carbon dioxide, water, and sulfur cause corrosion in upstream and downstream facilities. Frost & Sullivan found that, of the approximately 650 oil refineries in the world, about 400 have the scale to deploy a corrosion monitoring solution, but only 50% of them currently do; most of these only monitor very critical assets.

Improvements in Sensor Technology Drive Real-time Monitoring

Sensing and monitoring solutions have matured and are much more affordable than they were five years ago. Sensor technology has significantly improved; electronics miniaturization allows installation in even the tightest spaces. API (the American Petroleum Institute) has helped drive the installation of monitoring solutions through recommended practices such as API RP 580 and 581 for risk-based inspection and technology and API RP 1176 for assessment and management of pipeline cracking.

CASE IN POINT

One of the largest refineries in the world installed connected sensors in the crude process streams and vacuum unit furnace outlets. The refinery has been able to correlate this data with crude flow performance data to arrive at a reliable metal loss model that has helped it manage crude blends and develop corrosion management strategies.

Installed sensing is poised to be particularly impactful in North American refineries, where corrosion is a growing problem because of the processing of different crude blends. Harsh environments can affect reliability. One of the major challenges for permanent ultrasonic sensors in the field for corrosion monitoring has been the supply of a couplant (such as water or gel) to carry out measurements. New material technologies, however, have overcome this. BHGE’s Rightrax PM ultrasonic sensors use BHGE’s proprietary SolGel™, eliminating the need for couplant, adhesives, or welding. The battery-powered Rightrax PM contains hazardous area-certified components, is designed to connect to a wireless mote manager, and has a footprint of only 1 square inch (25.4 square mm)—ideal for permanent corrosion monitoring.
**Significant Benefits of Predictive Corrosion Management**

Sensorization and predictive analytics have changed asset management from reactive to proactive. These technologies add immense value to corrosion monitoring systems, as shown in exhibit 1.²

Exhibit 1: Plant Asset Management Strategies

<table>
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<tr>
<th>Reactive</th>
<th>Preventive</th>
<th>Predictive/Proactive</th>
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<tr>
<td>- Maintenance on failure</td>
<td>- Planned maintenance as per schedule</td>
<td>- Maintenance based on asset health and its condition</td>
</tr>
<tr>
<td>- High risk of unplanned downtime</td>
<td>- Savings of 12 - 18% over reactive methods</td>
<td>- Saving of 30 - 40% over reactive</td>
</tr>
<tr>
<td>- High pressure environment in case of asset breakdown</td>
<td>- Prevents major asset failures</td>
<td>- Cost saving of 8 - 12% over preventive by avoiding unnecessary maintenance</td>
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<tr>
<td>- Production losses and high lifecycle cost of asset maintenance</td>
<td>- Improves asset performance</td>
<td>- Optimization of asset performance, reliability, and life expectancy</td>
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*Source: Frost & Sullivan*

- **Inspection costs** decrease by 30% to 40% due to proactive maintenance and the elimination of unexpected downtime with better decisions derived from continuous data flow.²
- **Safety** improves because asset operators receive warnings about critical faults and can prevent catastrophic failures.
- **Process efficiency and asset life** improve through better knowledge of corrosion tolerance levels.
- **Corrosion inhibitor costs** decline because of more effective usage.

Refinery operators use corrosion monitoring data to make decisions about the grade of feedstock that can be run through pipes. Lower-grade feedstock can improve profit margins but tends to be more corrosive. In upstream operations, the higher the oil extraction flow rate, the quicker pipes corrode. According to a research by Frost & Sullivan, some oil well operators that have installed permanent wall thickness monitoring sensors are seeing payback in three to six months¹.

BHGE’s Predictive Corrosion Management is a cloud-based proactive maintenance solution built on Predix, GE’s industrial operating system and Software Development Kit for IIoT applications. It remotely monitors interior pipe wall thickness and assists in estimating the time remaining until corrosion progresses beyond permissible limits so that operators can plan for maintenance downtime. The move from periodic inspection to continuous corrosion monitoring is inevitable because of the technological advancements, affordability, and high return on investment.
CONCLUSION

Digital inspection solutions for corrosion monitoring are becoming essential for operators to drive efficiency and profitability. In the next two to three years, a major shift will disrupt the inspection landscape. Anchored by predictive and prescriptive maintenance strategies, integrated and collaborative technology will be employed to monitor and manage a variety of asset classes and transform operational and business decisions about performance and safety. Companies of all sizes are ramping up digitization to build smarter, faster, and more responsive asset protection strategies, and are broadening their focus from capital expenditure to total (capital and life cycle operating) expenditure. In short, they are considering the life cycle costs of entire systems.

REFERENCE

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