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Looking to boost safety? Reliable operations are the key

Equipment failures are the thorn in every industrial plant's side. However, these failures cause much more than frustration and lost productivity. The hours surrounding equipment shutdown or startup—known as transient time—present the highest risk for safety incidents, as well.

During equipment failures, as staff focus on repairing the asset and doing everything possible to bring production back up, it is not uncommon to overlook basic safety precautions. The increase in safety risk during transient times is staggering. A typical refining or petrochemical facility spends less than 10% of its time in transient operation, but more than 50% of process safety incidents happen during this time.[1] According to the National Response Center Database, approximately 40% of process safety incidents can be tied to mechanical integrity.

Since 2004, Goldman Sachs has incorporated ratings on oil companies' environmental, social and governance (ESG) performance into research. Firms scoring highly on issues such as employee safety tend to also produce higher returns on investment. With a direct relationship between unexpected downtime and safety incidents, companies have an even bigger incentive to keep their equipment up and running. However, when plant workers already strive to avoid downtime, what more can be done?

It turns out, a lot. Impacting reliability starts with a mind—and culture—shift. Companies have traditionally used "reliability" as a synonym for maintenance and having the right parts and team members to repair and replace assets to minimize downtime. However, forward-thinking companies are quickly learning that reliability is not about quickly fixing a problem, but is rather about having the actionable, real-time data and analysis needed to alert and prevent abnormal operation or imminent failure in the first place. Many refiners have found a direct correlation between running-to-failure and incident rates.

A 21st-century reliability program focuses on creating a proactive, top-down strategy that leverages Industrial Internet of Things (IIoT) technology. The IIoT makes it possible to gain real-time insights on the health and performance of industrial assets and to act before a problem arises (**FIG. 1**).

Through online monitoring and quick analysis of data streams, it is as if unit managers are wearing X-ray glasses that enable them to see inside the process and health of assets to anticipate needs and take the necessary corrective actions. An effective reliability program enables operators to detect small variations in performance and take actions to prevent issues (**FIG. 2**). Giving employees actionable information and an opportunity to address reliability issues outside of the chaos of unplanned downtime are crucial components to a safer plant.

FIG. 1. Dashboards provide real-time, clear overviews on asset health.

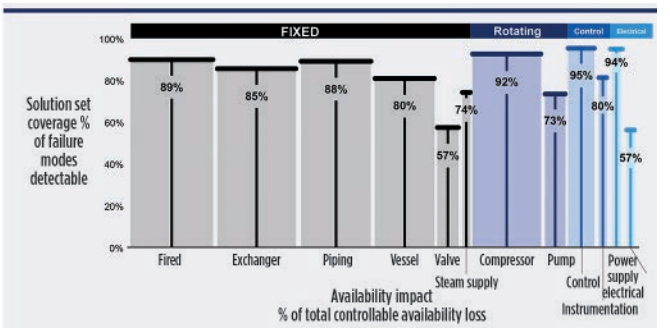

FIG. 2. Pairing a comprehensive decision support process with a solid technology foundation (condition and predictive) can transform performance.

Most older refineries were designed and built with the minimum amount of instrumentation needed to safely operate the refinery, but not necessarily to operate it efficiently or reliably. Instrumentation was expensive in the past. Typically, only critical assets were wired with online monitoring and/or protection. Plants had to rely on tedious and time-consuming manual tasks to gather information, rather than online monitoring. At present, instrumentation is relatively inexpensive, but it is the wiring installation costs that prohibit additional process and asset health monitoring capabilities.

Online data from sensors has been available for decades, but a transformation is taking place due to the low cost and quick installation time for wireless sensors when compared to their wired counterparts. Wireless applications include vibration sensing of rotating equipment, ultrasonic leak detection, steam trap monitoring, corrosion detectors and flows, pressures, secondary levels and temperature measurements. These and

FIG. 3. Taking a predictive maintenance approach to asset health can positively impact safety and reduce unplanned downtime.

FIG. 4. Online data provides plant operators with actionable information to improve asset reliability and efficient operations.

other wireless sensors are providing additional insight into asset health at many process plants. This awareness has resulted in lower maintenance costs and energy usage, while reducing downtime and mitigating the probability of a safety or environmental incident (FIG. 3).

Online data from sensors—both wired and wireless—should be analyzed and used to provide plant operators with the actionable information to make timely decisions for improving asset reliability and efficient operations. Data from these additional sensors can be analyzed and turned into information by a variety of commercially available software programs, each of which can evaluate and provide alerts on process and asset health data for abnormal operation. Properly trained operators are invaluable in this process, as they not only act on information from predictive analytics software, but often make decisions on their own.

The traditional approach has been to collect and historize process data, and then only use the data to look back and evaluate after an incident. The new approach is to use predictive analytics software to automatically analyze data and turn it into actionable information. This modern process looks forward and sends alerts before abnormal operation or imminent failure, making it possible to take appropriate action to avoid asset failure. For example, failure mode and effects analysis (FMEA) data confirm that the right predictive technology can detect more than 70% of potential failure modes for nearly all assets, along with a higher percentage for assets that have the greatest downtime impact in refining (FIG. 2).

Refiners can utilize software developed in-house or purchased from solutions providers. Advantages and disadvantages exist for each. Home-grown software can cost more than commercial, off-the-shelf software—when the internal hours required are considered—and can take longer to implement. The advantages of a solutions provider software package are that it is easier to scale up for many assets, and the software is maintained by the supplier. The disadvantages of a solutions provider software can be higher out-of-pocket costs compared to in-house development, and customization may be be required to match site-specific needs.

While this new asset health information can be effectively used to mitigate abnormal operation and asset failure for day-to-day operations, it can also be used for turnaround (TAR) planning. Obtaining a sufficient number of skilled workers for a TAR is challenging, and it is no longer competitive to touch all assets during a TAR. The result is that the scope of TARs has been reduced from a traditional duration. However, the primary question remains: How was the scope cut? Most refiners utilize a risk-based matrix calculation that may or may not include asset health measurements. Best practices utilize asset health insight (beyond a single data point) with integrating risk analysis into the deferred maintenance decision-making. Having additional online asset health trends ensure that only the assets needing attention during a TAR are part of the scope. This also provides confidence that an asset requiring attention was not missed when reducing the overall scope.

The benefits of monitoring asset health in real time are myriad. In addition to impacting safety, asset monitoring technology and analysis enable processing facilities to maintain peak production levels by proactively managing equipment downtime. In an industry where around-the-clock production is a necessity, the opportunity to increase safety, while enhancing production, is a win-win. HP

LITERATURE CITED

[1] Miklovic, D., "Why 10% of your operations cause 50% of your safety incidents," online: http://blog.lnsresearch.com/why-10-of-your-operations-cause-50-of-your-safety-incidents

In his role as Emerson Automation Solutions' Senior Director of the global refining and chemical industry, **MARCELO CARUGO** leads the refining program with a team of experts. He has 30 yr of experience within the refining and petrochemical industries. His expertise includes the use of technology to improve plant economics, operations, regulatory compliance and reliability. Mr. Carugo holds an MS degree in electronic engineering from NUFFIC, The Netherlands, and an electronic engineering degree from the University of Buenos Aires.