TRANSFORMING INLET SEPARATOR PERFORMANCE

Tom Mazzacavallo, Nalco Water, an Ecolab Company, USA, shares insight on how gas processing facilities can build a proactive maintenance strategy with a comprehensive programme to ensure the performance of inlet separators.

In the energy sector, gas processing facilities play a critical role in refining natural gas to meet stringent quality standards for domestic and industrial use. As raw gas travels from wellheads to processing plants, it carries a complex mix of methane, ethane, propane, and other components, such as acid gases (H_2S and CO_2), water, condensate, and various foulants like solids and salt. The primary objective of these facilities is to purify the gas, stripping away these contaminants to help meet industry standards required for both home and commercial use.

Central to this purification process is the acid gas removal unit (AGRU), which utilises technologies like amine absorption to remove acidic gases from the incoming gas stream. The inlet separator plays a vital role in processing, helping to separate out natural gas liquids, water, and solids before the gas enters the AGRU. This process helps prevent physical contaminants from damaging the equipment or hindering the absorption process. Additionally, compressors are used to pressurise gas to the necessary levels for effective processing, helping the gas to maintain the correct pressure throughout the treatment stages.

Fouling poses a significant challenge to the efficiency of gas processing operations. When the inlet separator is not working properly or is exceeding its designed flow rate, solids and other particulates can pass through the separator to downstream equipment, potentially leading to operational inefficiencies or equipment damage, if not promptly addressed. Without a proactive programme, operators are often forced to schedule

frequent and costly maintenance to manage fouling in the equipment of the plant, such as compressors, absorbers, or lean/rich heat exchangers. These maintenance activities are expensive and time-consuming, leading to potential downtimes that can disrupt the overall productivity of the facility.

When inlet integrity is neglected, not only is equipment at risk, but the entire process. Contaminants like solids and salts can travel through the system, causing corrosion, fouling, and unplanned downtime. By prioritising inlet integrity, plants can help to safeguard downstream processes.

Nalco Water, an Ecolab company, recently launched a programme to help gas processors manage fouling and support efficient performance. The Inlet Integrity Programme combines products with localised service and digitally enabled reporting to help companies identify and address challenges, before they can cause significant impact.

The programme features patented chemistries, such as an iron sulfide inhibitor and corrosion protection product, which minimises the formation of harmful deposits. The programme also includes an inlet separator solid removal enhancement product that effectively removes suspended solids from the incoming gas stream. The products can be utilised together or separately depending on the needs of a specific operation. Supported by the company's tailored offerings, the programme helps drive operational efficiency and reliability at an optimised operating cost.

Inlet integrity in action

The programme was implemented at a gas processing facility near Midland, Texas, US, where high compressor fouling rates were leading to frequent downtime for cleaning and maintenance. An average of one compressor per day was shut down due to overheating valves, commonly called 'hot valves.' This not only incurred high costs but also consumed significant personnel time and occasionally led to the flaring of the backed-up gas.

The facility's challenges required a detailed understanding of specific operational issues. As a first step, Nalco Water focused on identifying the root cause. Samples from the compressors were sent to the company's analytical lab, where analysis revealed that the deposit primarily consisted of salt. Based on these findings, the company recommended introducing a compressor antifoulant product designed to help remove solids and dissolved salts from the gas stream in the inlet separator, enabling them to be efficiently removed through blowdown water.

The product was injected into the pipeline a few feet upstream of the inlet separator, using an atomiser to ensure even distribution throughout the gas stream. Samples of the blowdown water were taken regularly to monitor salt content, while the plant closely observed compressor performance to determine whether maintenance frequency decreased. This data, along with additional analytical reports, was uploaded to the ECOLAB3D™ digital intelligence platform through a mobile app to help the plant review and understand trends.

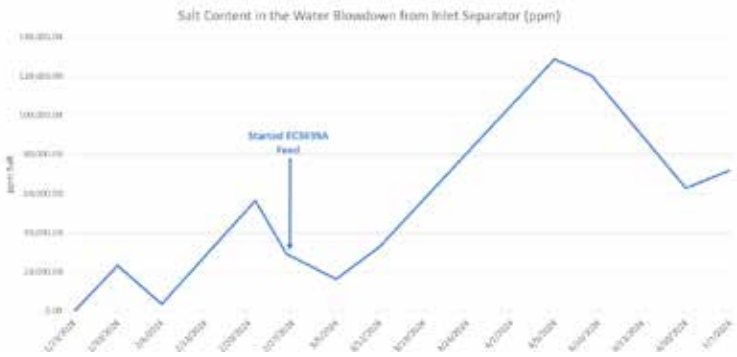

Figure 1. Blowdown samples.

Figure 2. Compressor valve two weeks into the trial (left) and after the 10-week trial (right).

When analysed, the results were promising. Blowdown water samples showed a significant increase in salt content, with salt levels rising approximately 250% compared to pre-trial samples (Figure 1). The data indicated that the treatment programme was effectively removing salt deposits from the inlet separator, preventing them from travelling downstream to the compressors or amine unit.

The trial ran for 10 weeks on the plant's most problematic compressor, which they selected to pilot the programme. Prior to the trial, the compressor required cleaning every three days. Two weeks after the introduction of the treatment product, the compressor showed no signs of fouling and no evidence of build-up (Figure 2, left). The trial continued for 10 weeks without any fouling-related issues. At the 10-week mark, the compressor was opened for inspection. As shown in Figure 2 (right), the valve remained clean.

With the solution in place, no compressors went down due to fouling or hot valves for the duration of the 10-week trial. The plant went from daily compressor maintenance to over a year without issues related to hot valves,

enabling operators to focus their time on other plant operations. The absence of compressor maintenance also saved significant costs related to labour and replacement parts, and led to other benefits such as reduced gas flaring. In total, the programme delivered a value of over US$300 000 and helped save 1255 t of CO_2 emissions for this specific plant.

Expanding the impact

The programme's ability to adapt to evolving challenges was demonstrated at another gas processing facility in western Texas, US. Initially, it was trialled on intermediate-pressure compressors to assess its effectiveness in reducing fouling and optimising efficiency. While these compressors had no significant history of fouling, the trial revealed critical insights that led to a more impactful application.

In the first phase of the trial, Nalco Water introduced the programme to the plant's intermediate pressure compressors. These compressors had not historically experienced significant fouling, making it difficult to quantify and benchmark the programme's value. Despite this, water analysis during the trial showed promising indicators – fewer solids reached the compressors, and six out of seven compressors operated more efficiently. When the company saw the improvements even in the absence of severe fouling, the team wanted to target a different part of the process to deliver even stronger operational benefits.

The team then turned to the low-pressure compressors. After switching its programme to an alternative solution, the plant was experiencing challenging fouling issues that needed a shift. The plant collaborated with the company to conduct a new trial for the programme – this time focusing on the low-pressure compressors where fouling was most prevalent.

The revised strategy applied a two-step treatment programme to address fouling at its origin. One product was injected upstream of the inlet separator. A second treatment was applied after the inlet separator, ensuring contaminants were neutralised before reaching the compressors. By intercepting the issues at the source, and treating the gas at two stages, the team helped to prevent fouling from reaching critical machinery.

As a result of the low-pressure compressor trial, the plant was able to extend cleaning intervals and reduce operational disruptions. Within a few weeks of implementing the second trial, the facility began seeing significant improvements. The frequency of hot valves in the low-pressure compressors decreased, and the overall efficiency of the system improved.

A proactive approach

The programme continues to add value across industry operations as it can help reduce midstream maintenance complexities, with success demonstrated at both gas processing plants and compressor stations across gas lines. The programme's holistic treatment strategy helps gas processors move away from reactive maintenance as they transition towards proactive performance management. By adapting the way that gas plants manage fouling, the programme aims to turn routine operations into cost saving efficiency opportunities.

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