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In the *pipeline*

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Liquid carryover:

the undetected hazard in natural gas operations

This common problem can have a major impact on efficiency and cost, but pinpointing it was notoriously difficult – until now. Paul Stockwell, from pipeline imagery experts Process Vision reveals a unique method for flagging liquid carryover and increasing the efficiency and profitability of operations

In natural gas processing and pipeline transmission systems, liquid carryover is an under-the-radar issue that presents considerable risks to both safety and operational efficiency. Existing industry guidelines, such as those provided by API and ISO, are not designed to address the complexities of unexpected two-phase flows, where liquid and gas coexist in the pipeline.

Traditional gas analysers using gas sampling from the main pipeline cannot detect this hidden problem, resulting in many process and metering engineers believing the gas is dry while liquids are, in fact,

actually present. This issue causes substantial economic losses for organisations due to unmonitored glycol and natural gas liquids (NGLs).

Alarming, 60% of failures in gas-processing plants are directly linked to liquid carryover, particularly at the crucial inlet stage where gas treatment occurs. Liquid carryover during these phases substantially hampers the efficiency of subsequent processes, such as de-sulphurisation and de-humidification. One notable and severe consequence of liquid carryover is foaming, which can require a dramatic reduction in gas flow and the use of de-foaming chemicals, incurring both production and efficiency losses. To mitigate this, operators intentionally restrict their gas flow rates, a measure that serves as a safety net but, unfortunately, also stifles maximum production.

Long-term challenges

The repercussions of liquid carryover for gas processors aren't just immediate but extend into long-term challenges such as fouling. Accumulated solids can lead

to clogged systems, decrease the performance of heat exchangers, and disrupt valves and pumps. Additionally, complications persist right to the final stages of NGL removal, which is often inadequately monitored. These issues cumulatively have a ripple effect, negatively impacting both system safety and an operation's profitability.

Once the gas is in the transmission system, further problems are introduced at compressor stations and power stations where liquids wreak havoc. They cause failures in dry gas seals, affect the accuracy of flow meters and cause long-term turbine damage in power stations.

Process cameras: providing real-time insights

Traditional computational fluid dynamics (CFD) models, despite

their complexity, cannot always predict the real-world dynamics of liquid carryover. This limitation underscores the critical need for real-time monitoring solutions, a gap that can be filled by the integration of process cameras. These advanced devices provide a window into real-time conditions, thereby aiding in precise process control and serving as a validation tool for conventional analyser data.

This new breed of cameras gives engineers a view inside a live pipeline. It is revealing that mist or stratified flows are frequently present when monitoring 'dry gas' systems.

Says Paul Stockwell, managing director of Process Vision, 'Once we started putting cameras onto gas pipelines carrying sales-quality gas, we quickly realised a mismatch between gas analysis systems that calculate the



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At a glance

- Liquid carryover, where liquid and gas exist in a pipeline, is significantly underreported.
- The effect can massively impact efficiency, cost and safety.
- Gas quality measurement systems are generally unable to handle liquid gas and do not register its presence – they simply don't faithfully represent what is in a pipe.
- A new breed of cameras gives engineers a view inside a live pipeline.
- These images can be turned into valuable data for process control, letting gas processors know when they are losing valuable natural gas liquids on the gas export line and revealing when the time is right to change out filter cartridges.
- This helps reduce costs, for instance for pigging, and helps to maximise operational performance.

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The presence of wet gas

In many cases, liquid events observed with the cameras did not cause alarms by any other analysis systems. This is because in sales-quality gas wet gas is considered a fault condition and therefore gas quality measurement systems are not designed to handle or register its presence. In layperson's terms, wet gas is 'outside of their remit'. Yet these very systems are (unwittingly) being relied upon

to alarm if wet gas is present!

Using cameras, wet gas is observed in a much higher percentage of time than you might expect. It is possible that NGL recovery (or dewpointing) systems – which reduce the temperature of the gas in order to 'dropout' as much NGLs as possible – might well be achieving the target temperature. However, if the temperature reduction is achieved by Joule-Thompson cooling when pressure is reduced, it is the perfect condition for a very fine mist flow to form. Unless high-level filtration is used

at low temperatures, NGLs will not be effectively removed.

From video to data

Cameras capture video evidence, and the next step is to turn images into data. This information can then be used as a new metric for process control, letting gas processors know when they are losing valuable NGLs on the gas export line and revealing when the time is right to change out filter cartridges. This monitoring allows the gas processing trains' performance to be balanced, to minimise carryover; it also provides an opportunity to

investigate any differences. Evidence-based action can be taken to improve phase separation and reduce the threat of foaming. For gas transmission systems operators, process cameras and the data generated provides an extra check on the acceptability of the gas coming into their system. This helps them reduce pigging costs and results in a significant reduction in compressor servicing costs.

In conclusion, tackling the 'hidden' risk of liquid carry over is essential for improving the safety and operational efficiency of both natural gas processing plants and gas transmission system operators. Using real-time monitoring solutions can extend asset life and maximise performance.

In an industry first, Process Vision LineVu cameras provide a view inside live pipelines. Visit processvision.com.

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