Oil and Gas INNOVATION®

Winter 2022

A Leading Voice
of the Energy Transition

HAZARDOUS AREA TECHNOLOGIES: SPECIAL

FOCUS: DOWNSTREAM AND PETROCHEMICAL TECHNOLOGY

FLOW CONTROL: THE LATEST INNOVATIONS

Winter 2022

Emery Hill Media
Dalton House
60 Winsor Avenue
London
SW19 2RR
Tel: +44 330 043 4969

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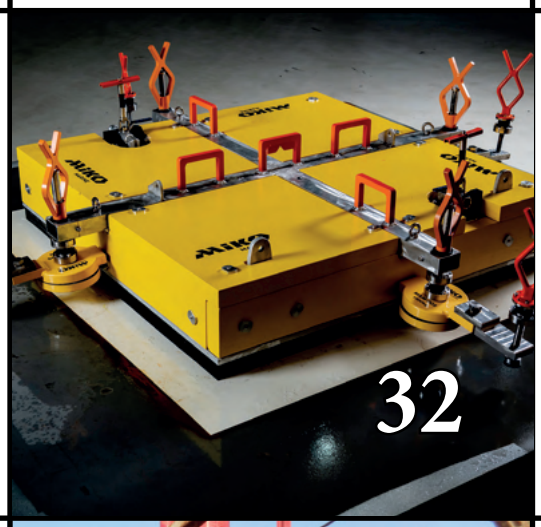

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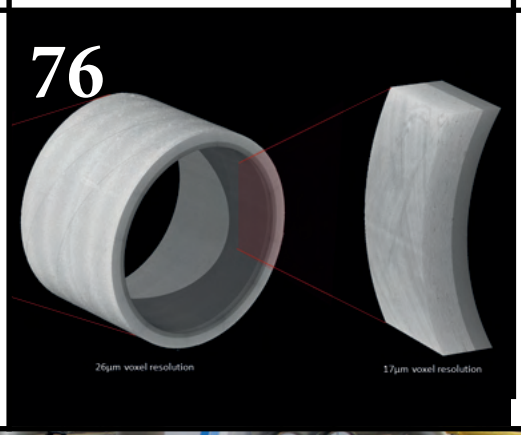

Liquid Carryover Detection to Improve Gas Quality & Foam Management

Before natural gas can be transported, acid gases, any liquids that could condense in the pipeline, must be removed. Operators must also meet water and hydrocarbon dew point specifications before the gas is suitable for entry into a national gas transmission system as sales gas. New technology is now being used to monitor the efficiency of separators, improving process control and the quality of gas supplied to gas networks.

The Natural Gas Journey

From the gas well through gas treatment, transmission and use, there are many points where liquids are injected and then removed to avoid corrosion, remove hydrogen sulphide, carbon dioxide and water vapour. Figure 1 illustrates the critical points where all liquids should be separated prior to moving the gas forward in the system. If liquids are not effectively removed, safety and process efficiency are compromised.

Gas/liquid separators are not 100% efficient, 100% of the time - their performance is one of the most common causes of problems and capacity constraints. Foaming, flow surges, start-up, shutdown, and flow ramping are all common causes of liquid carry-over.

1. At the entry to gas treatment process, all condensate, corrosion inhibitor and anti-hydrate liquids present in the gas stream should be removed (if not, foaming occurs during gas treatment that can severely limit production by 50% or more).
2. Loss of amine due to carryover into the dehydration system can be costly and cause further process problem in the dehydration unit.
3. Liquid carryover from the dehydrator can cause serious damage to a mercury removal bed (if present). Dew pointing reduces the temperature of the gas to remove as much condensate as possible. If glycol enters this system, it can freeze and cause blockages and temperature control problems.
4. Effective removal of condensate ensures that maximum value is extracted from the gas. If any liquids are present in the sales gas at the custody transfer point the supplier can be accountable for breaking the tariff agreement and be fined, the sales price can be re-negotiated, and the supplier can be held responsible for the clean-up and rectification of the network.

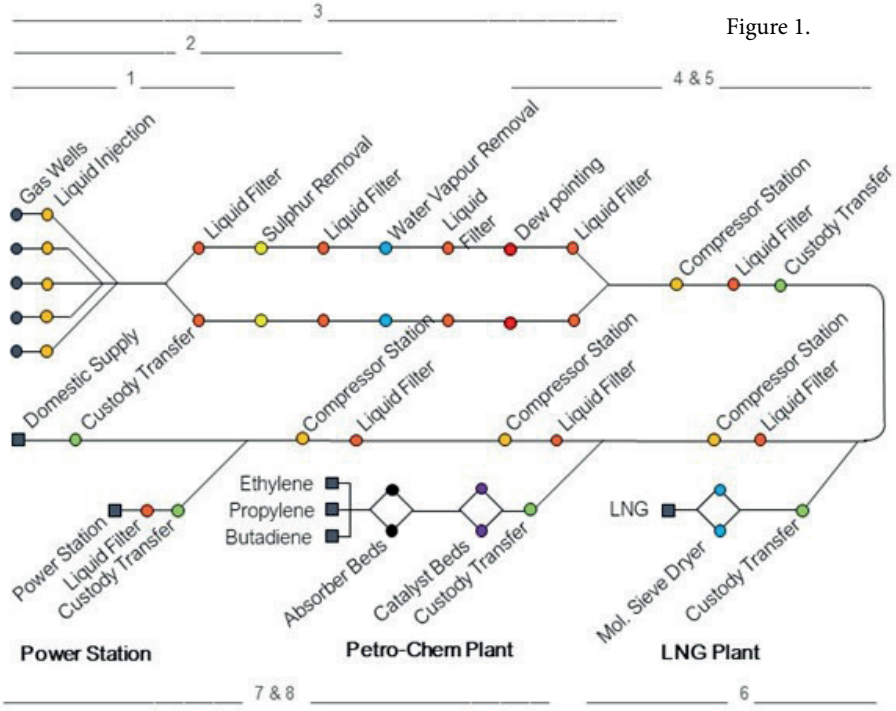

Figure 1.

5. Once in a gas network, liquids can accumulate at a low point in the network and cause corrosion or then move forward as a slug of liquid that can damage compressors and sensitive equipment downstream. Separators should be monitored and maintained to ensure optimum performance to prevent liquids entering compressors stations, causing dry gas seal failures and excessive valve wear. Compressors themselves can be responsible for contaminating gas supplies allowing around 20 litres of lubrication oil into the system when seals fail.
6. Dryers are damaged when liquid slugs enter a molecular sieve, and their life is insidiously reduced by small, constant, undetectable liquid carry-over.
7. Fuel gas (and other gases present in refineries and petrochemical plants) are often required to be free of liquids. This is because catalysts, distillation towers and absorption beds can be damaged or written-off if liquids are present.
8. Liquids in the fuel gas entering gas turbine power stations and combined heat and power units causes significant damage by corrosion, pitting or melting the turbine blades. An unbalance in the rotors then occurs leading to complete failure.

Processing liquids (amine and glycol) used in desulphurisation and de-humidification and compressor oil are the most common liquids found in transmission networks. These are designed to have an extremely low vapour pressure and therefore difficult to detect with conventional gas analysis systems. Gas analyser systems are intentionally designed to

avoid and remove liquids that may be entrained in the gas stream. In the case of water vapour and hydrocarbons, analysers can report that the gas is saturated but not the amount of liquid in the gas stream.

Lack of suitable monitoring and alarm systems are the cause of liquids being known as "the silent killer" - often discovered to be the cause of serious incidents.

Undetected liquids cost the industry $Ms every year in damage, lost revenue, and labour costs.

LineVu

LineVu is a new ATEX certified system designed to detect liquids, hydrates and foam. LineVu will provide improved process control and accountability.

Permanently installed on a standard tapping point above a pipeline or process, LineVu is a camera and illumination system using image processing to trigger an alarm if contamination is seen. A live video stream is available to operators to allow improved process decisions to be made and to review process incidents. Upon activation of the alarm, LineVu automatically starts to record the event. This can be used for:

- Process de-bottlenecking.
- Investigations to increase production.
- Diagnosis of faults:

  - Ensuring separator performance is maintained.

  - Filter cartridges have been installed correctly.
- Training.
- Evidence to support operational decisions.
- Evidence to form the basis of compensation claims.

LineVu does not intrude into the pipeline (allowing lines to be pigged) as the on-pipe system is mounted above the pipeline.

With the provision of better information, LineVu is being used by gas networks to effectively reduce contamination improve process safety, lower maintenance costs and extend asset life.

LineVu includes a patented, secondary containment system ensuring that there is no loss of containment under any circumstances and provides a level of safety sufficiently high enough for permanent mounting on a high-pressure gas system.

With the Camera Can of LineVu usually mounted behind an isolation valve, it creates enough stand-off above the gas stream to prevent contamination of the optics when liquids are present. The heat produced from the illumination system is managed so that the windows remain a few degrees higher than ambient, and therefore condensation on the windows is prevented when monitoring pipeline gas that is saturated.

With a class 900 flange, the standard system has a maximum pressure rating of 2,220 psi (153 Bar). Higher pressure ratings are available if required.

Security of the client's network is a priority, with the communication system designed accordingly.

The user interface is web compliant. A live video feed can be made available in the control room or remotely to ensure improved accountability when multiple assets are connected to the network or tie-back.

Video data at the Camera Can is compressed, encrypted and stored at site. Date, time and serial number are burnt onto the video prior to leaving the Camera Can.

Once on the secure platform, data is presented on an encrypted viewing platform with two-step verification for approved operators and service personnel.

The system uses image metadata and machine learning for full image analysis. When a contamination event occurs, it is categorised into the severity level, an alarm is automatically generated, and video is recorded. Several notification routes are available upon an alarm condition including:

- Volt free relay activation.
- SMS texts.
- E-mail.
- Push video notifications.
- Push still shot notifications.

With better information available to process engineers, LineVu is increasing up-time, improving process safety, lowering maintenance costs, and extending asset life. Improved knowledge of liquid carryover is enabling engineers to improve the performance of separators in the field to provide improved process control and better accountability. •

Process Vision Ltd

t: +44 (0)1256 883 304

e: info@processvision.com

w: https://www.processvision.com

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