

WORLD PIPELINES

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Moisture: locking it out with lasers

Sam Miller, SpectraSensors Inc., USA, presents reliable NASA-based gas analyser technology that keeps oil producers informed of moisture content in a pipeline, helping to prevent expensive shut-ins during operations.



Since gas produced at the wellhead often contains contaminants; it must be cleaned and brought to 'pipeline quality' before it can be safely delivered to high-pressure or long distance pipelines. Natural gas that does not fall within certain moisture levels can cause operational problems, pipeline corrosion, long-term deterioration and even pipeline ruptures.

In the past, many natural gas producers, processors and distributors have relied on direct contact, surface-based electrochemical and crystal sensors for measurement of residual moisture in gas. However, this older sensor technology has proven highly unreliable, and gave false data that resulted in unwarranted shut-ins and contaminated gas passing through lines.

"If we were to shut-in a producer due to a false moisture reading, millions of cubic feet of gas could be delayed, and this could incur unnecessary dehydration costs," commented Melvin Yancey, a Field Measurement Technician at the El Paso Natural Gas Company's (EPNG) San Juan District in the Four Corners Area. "On the other hand, if the gas does not meet EPNG's criteria for quality, as required in

our tariff, we would not take the gas and the gas may have to be vented”.

To avoid those possibilities and meet quality standards of pipeline gas, EPNG has installed new laser-based sensor technology at the location where each of its 16 major producers in the San Juan area joins the pipeline.

Marketed under the SpectraSensors brand, this technology has proven to be far more advanced and trustworthy than other sensors. It uses a Tunable Diode Laser-based (TDL) technology

developed at NASA's Jet Propulsion Laboratory at Caltech. SpectraSensors, Inc. is currently one of the leading developers and producers of optical-based gas sensors. The 'bread box-size' gas analyser provides non-contact measurement of moisture, carbon dioxide and other corrosives in natural gas pipelines.

The benefits of laser sensors

Tunable laser-based gas sensors are fast, accurate and flexible, as well as cost effective. While initial purchase price is somewhat higher than surface-based gas sensors, even the most conservative evaluation of this advanced technology indicates that the maintenance saving alone will provide a return on investment in a relatively short period of time.

EPNG feels that pipeline operators and producers alike are in need of ongoing and accurate gas analysis. “If there were faulty or bad readings”, Yancey said, “then the customer is going to dispute why I shut them in. Let’s say a producer is piping hundreds of millions of cubic feet of gas. So, if I shut in that producer, the cost could be immense”.

Each producer can monitor El Paso’s gas analyser readings by capturing the electronic signal from El Paso’s unit via a SCADA system and viewing the readings in the producer’s control room.

Considering the downside risk of moisture in the gas, and that SpectraSensors are monitoring the quality of gas worth tens of millions of dollars each day within this area of EPNG’s transmission alone, it is reasonable to conclude that this laser-based sensor system could pay for itself in a brief period of time.

As an example, transmission pipeline operators have traditionally relied on electrochemical sensors as gas analysers to monitor moisture. These sensors incorporate a coated surface and a higher electrical capacitance across the surface indicates higher water content. However, these capacitance sensors are susceptible to contamination by glycols or amines in the gas, which can cause exaggerated readings or a failure to detect.

An erroneously high reading could force the operator to temporarily shut down the pipeline, costing the company tens, or even hundreds, of thousands of

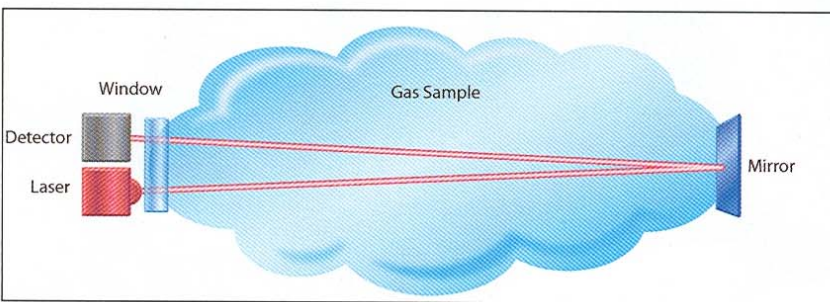
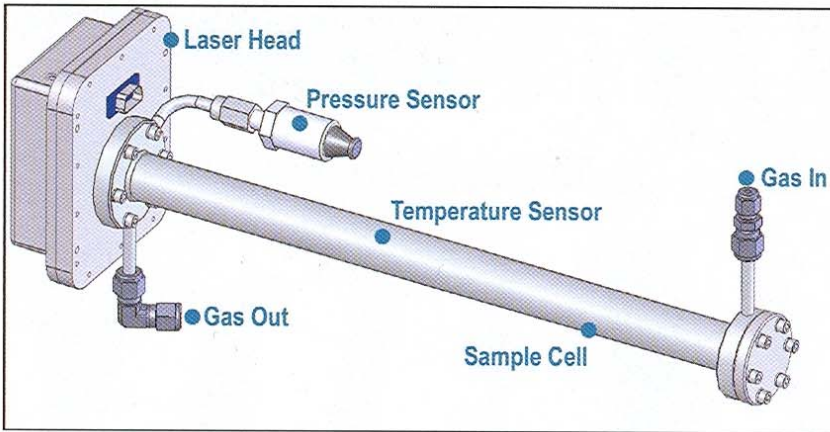


Figure 1. The high spectral purity of a laser-based analyser enables the detection of specific gases, such as water, ammonia and carbon dioxide, in natural gas pipelines.

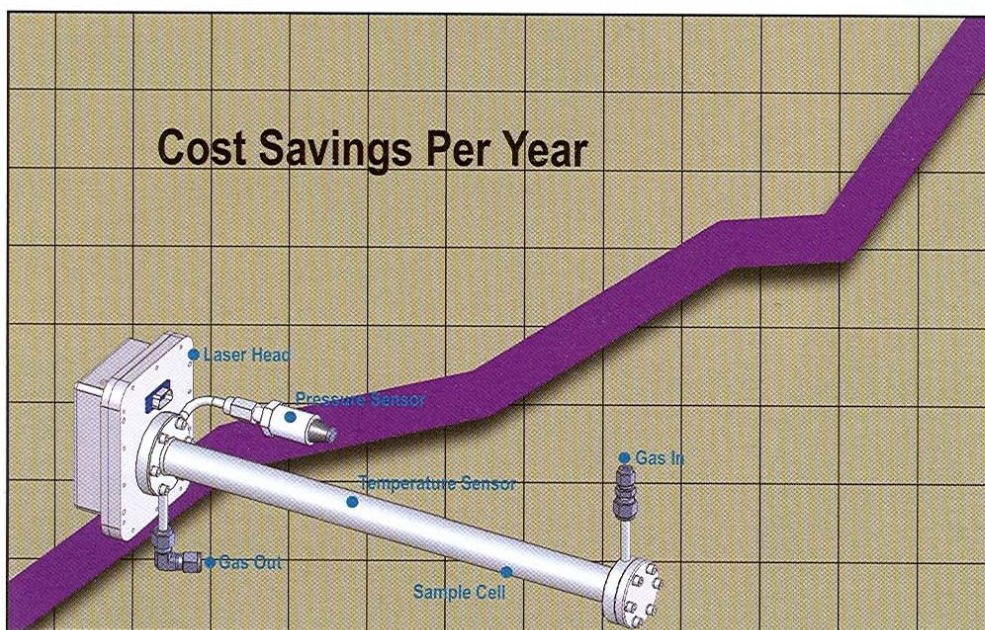


Figure 2. SpectraSensors’ natural gas sensors provide significant savings. Its NASA-based laser technology is fast and accurate with low associated maintenance costs.

dollars. The gas producer may choose to over-process the gas to ensure it is within the tariffs imposed by the pipeline operator. Because the laser-based gas analyser responds quickly and provides a reliable measurement that will not drift, it can be used in a closed loop to control the blending of dry and wet gas, allowing the producer of pipeline to optimise costs by staying just within the tariff.

As a laser system never comes into contact with the contaminants present in natural gas, as opposed to electrochemical and crystal gas sensors, the laser-based gas analyser practically eliminates maintenance and operational costs. Studies show the cost of operating and maintaining 'conventional' electrochemical sensors carries a cumulative annual expense often exceeding US\$ 50 000 per unit, including labour, recalibration and rebuilding, back-up sensor heads, as well as unnecessary gas dehydration and tariffs - all of which are obviated by the laser-based gas sensor.

A case study

Looking at the available technology, the measurement engineers at Williston Basin Interstate Pipeline (WBIP) could see the potential savings in replacing their aluminum oxide probes with laser-based moisture analysers. Measurement engineer Nate Hagerott explained that the company compared the numbers, and it appeared that there could be a significant saving on the costs of refurbishing or replacing probes, as well as a considerable labour saving on the part of field technicians.

WBIP provides natural gas transportation and underground storage to customers throughout the upper Midwest US states. As a subsidiary of MDU Resources Group, Inc., the company provides services to utilities, natural gas production companies, energy marketing firms and large industrial consumers.

Hagerott, who works at WBIP's Montana operations, says the company purchased a SpectraSensors gas analyser in 2005 to find out if the new technology could provide the consistent accuracy that would make it trustworthy in the field.

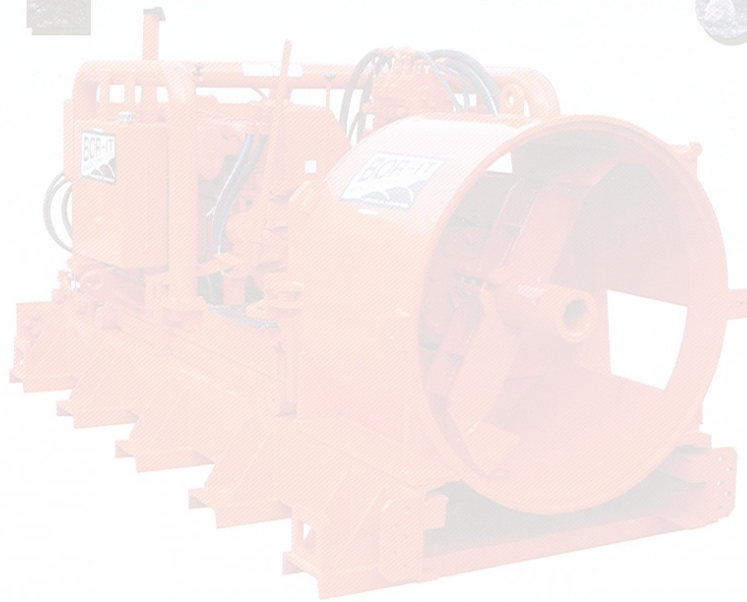
For the first few months, the company compared the laser-based natural gas analyser with the Bureau of Mines chilled mirror hygrometer. "The readings were consistently within 1/10 pound. Engineers have since found it unnecessary to compare it as often

as they did at first, because they have found that they can trust the readings.

Conclusion

Other pipeline operators are using the new moisture analyser technology, too. Their goals vary from saving on maintenance and labour costs to ensuring that moisture does not cause customer complaints or dangerous pipeline corrosion. The new laser-based technology precludes such problems through parts-per billion accuracy and through measurement intervals as frequent as every second, as opposed to the 10 - 12 minutes between readings typical of contaminant-vulnerable quartz crystal and electrochemical sensors. ●●●

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