Expanding role of analyzers in natural gas measurement

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Advances in analyzer technologies, along with the presence of renewables and hydrogen in natural gas pipelines, has created a renewed interest in natural gas analysis.

The role of gas analysis expanded slowly for decades as custody transfer made a transition from volume to energy basis. Since the discovery of shale gas and as renewable natural gas and hydrogen blending gain traction, gas sampling and analysis have accelerated markedly, far surpassing the levels achieved prior to 2010.

The introduction of new measurements by recently developed analyzers presents distinct challenges to pipeline and gas distribution system operators. Each measurement requires a unique knowledge set in order to obtain meaningful results, and individual analyzers present a challenge to both understand and maintain in the field. Additionally, integration grows more complex as the number and sophistication of each piece of equipment grows.

Natural gas analysis usually falls into one of three categories: custody transfer, compliance or safety. Analyzers tend to be located in clusters with individual analyzers measuring different components for multiple purposes. Natural gas sampling is the art of extracting a natural gas sample from a pipeline and then adjusting the sample (pressure, temperature and flowrate) to meet the requirements of the analyzers. Taken together, these requirements have resulted in the concept of the “analyzer shelter.” Many analyzers receive a gas sample for analysis from a common sampling point on the pipeline, chosen to yield a representative sample for the entirety of the system.

Custody transfer is the buying and selling of natural gas and is measured in units of energy. Gas chromatography has been the technology of choice for nearly four decades to establish the energy yielding components of the natural gas stream. Hydrocarbons ranging from the simplest molecule (methane) to longer and more complex molecules (ethane, propane, butane, pentane and hexane) are separated and quantified using automated, online chromatography systems continuously.

Chromatography also yields a few other key components of the gas mixture like nitrogen content, a non-energy yielding gas. As natural gas mixtures have become more complex and “rich” from shale gas contributions, the need to analyze larger molecules, like heptane, octane and nonane, has become necessary to accurately determine the energy value of the mixture. Gas chromatography is a well-established and highly accurate methodology, but the analysis itself can take several minutes to complete. For real-time analysis, other methods may be preferred.

Different analysis methods have been developed to measure single, yet important components commonly found in gas streams. Compliance to maximum thresholds are included in most tariff language including oxygen, moisture, carbon dioxide and hydrogen sulfide.

Taking these in order, oxygen must be controlled in pipelines principally to prevent corrosion. Oxygen is a key component in the formation of different acids, depending on other components, which create safety concerns. Moisture (water) is also monitored carefully due to corrosion concerns and to prevent operational difficulties associated with freezing. Carbon dioxide and hydrogen sulfide are both measured to monitor the potential for carbonic acid and sulfuric acid production, both capable of attacking pipeline materials.

The introduction of renewable natural gas into pipeline and distribution systems has raised the level of analysis necessary to maintain safe operations. Renewable natural gas (RNG) is neither renewable nor is it natural gas, but rather methane generated from waste products that is cleaned to a level suitable for injection into a natural gas pipeline. The RNG must meet the same tariff requirements of any other produced gas prior to injection.

Siloxanes, a group of organic silicon-oxygen containing compounds, are particularly harmful to rotating equipment when combusted because of their abrasive quality. Mercury is another potentially harmful metal that might be present from landfill sourced RNG.

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