Production of Pipeline Quality Gas from Low Quality Production

By: George McKinney

Processing natural gas from its produced state to pipeline quality may require a variety of procedures, ranging from simple filtration, through dehydration to remove water, up to advanced procedures. These may be required to remove excessive quantities of heavy hydrocarbons, hazardous components such as hydrogen sulfide, or inert gases such as carbon dioxide or nitrogen. Economics of the processes must be carefully evaluated to provide the required gas conditioning while minimizing the cost of operation. Historically, removal of inerts and oxygen has been oriented toward large scale plants, using processes such as amine extraction, Selexol processes, or refrigeration cycles with fractionation columns. Typically, these facilities have been specifically designed, treating gas streams of 100 MMscfd or higher. This type of plant is usually associated with a large gas field, or at the outlet of a gathering system.

The processes listed above can work very efficiently, and depending on the process and plant design, can remove almost all gas contaminants. Due to their complexity, initial cost or operating requirements, they may not be appropriate for a small producer. This can result in gas supplies that are shut in due to cost of production. In the case of coal bed methane extraction, production is often required to pull gas from coal production areas. The operator is then faced with the problem of upgrading the gas to saleable quality, or the prospect of venting or flaring the untreated gas. This is unsound, both economically and environmentally.

With rising prices for natural gas, many companies are examining the economics of producing gas with high levels of carbon dioxide, nitrogen and/or oxygen. Carbon dioxide may be associated with a particular well or field, while nitrogen and oxygen are usually found in coal bed methane gas streams. Up to this point, many wells or small fields have not been produced due to these gas contents. The processes listed above do not have good economics with small flows, so alternate processes are needed, with good economics in the range of 500 Mcfd to 10 MMscfd.

Two processes are available which can operate profitably in this flow range: either membrane osmosis or pressure swing adsorption. Both have the advantage of having no moving parts in the separation cycle, and acceptable for unattended operation. The osmosis process works well for carbon dioxide separation, but is easily contaminated with water or hydrocarbons. The pressure swing adsorption process will remove nitrogen as well as carbon dioxide, and will operate with nominal moisture content.

For an unattended field production operation, the adsorption process would be the best choice. With this system, three or more contactors are used, similar to a dry bed dehydration system. The gas is passed through a contactor tower filled with specialized adsorption beads, designed to catch nitrogen and carbon dioxide molecules, while rejecting methane. The contactor is placed in line for a timed period, then goes through a regeneration cycle. Gas in the vessel is recycled back to the plant inlet to maximize methane recovery. Then, with the vessel near atmospheric pressure, a vacuum pump is used to pull the inerts (carbon dioxide, nitrogen and oxygen) from the bed. These, along with some residual methane and heavier hydrocarbons are pumped to a separate line. This stream can be either flared or used as a low quality fuel, as for a burner or a generator engine designed to operate with low BTU fuel.

A main advantage of this process is that it will remove both carbon dioxide and nitrogen with the same equipment, and with no chemical processes or refrigeration. This allows a simplified operation which lends itself to automation or unattended service. Additionally there are no hazardous chemicals, and only normal safety precautions are needed.

With the price of gas in the range of $5 per Mcf, it is possible to see payoffs of less than two years for installation of gas processing equipment. When cost of money and operating expenses are considered, rough costs for processing gas to remove inerts can be on the order of sixty to seventy cents per Mcf. These costs can then be balanced against sales revenues, to show potential income of more than $100,000/month for an inlet stream of one million standard cubic feet per day.

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He is the author of "Compressor Station Basics," a manual for operators, supervisors and engineers containing basics on compressor station equipment and operation.

Some of his additional accomplishments throughout his 30+ years in the gas industry include: Creating a Computer- Based Pump Reporting System for Columbia Gas, increasing storage rate/unit efficiency at major gas storage facilities, engineering an active load control on a high-speed compressor, avoiding cost of station installation by control change, increasing station efficiency and eliminating maintenance costs and reducing the cost of compressor installations.