VIKING PUMP®

ENVIRONMENTAL IMPLICATIONS OF GLYCOL DEHYDRATION

A White Paper by

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Introduction

Traditionally, Viking Pump® has been concerned about regulatory compliance, especially as it relates to designing and manufacturing industrial pumps for customers who operate in potentially hazardous applications. The natural gas dehydration application is one such example of a current-day need to assure that this critical processing step is conducted in an environmentally safe manner.

The Environmental Protection Agency (EPA) has reported that electric-driven pumps—the only kind provided by Viking—produce significantly less methane emissions than their gas-assisted counterparts when it comes to TEG dehydration. Elimination of any pathways for contamination to escape into the atmosphere is the ultimate goal.

This white paper describes the benefits of using glycol pumps driven by electric motors, including cost savings, and how they help meet strict EPA requirements. The TEG dehydration process is intentionally not covered, as it is described in detail in another white paper published by Viking Pumps, *Meeting the Challenges of Glycol Dehydration*.

Background

In remote locations, where more and more natural gas resources are being exploited, glycol dehydration pumps are often powered by pressurized natural gas. However, these pumps present an environmental threat since they vent methane to the atmosphere as part of their normal operation.

Methane *is the main component of natural gas. So, leakage throughout this industry releases methane straight into the atmosphere. This includes the extraction, processing, and transportation of natural gas.*

Dealing with methane

Although methane is essentially non-toxic and can be harnessed as an energy source, it is highly explosive and may cause death by asphyxiation if leaked. It is, therefore, important to understand how to deal with the hazards associated with methane during processes like glycol dehydration. From a pump standpoint, such hazards can be dealt with by simply switching to a different type of pump.

According to the EPA, companies can "achieve significant methane emission reductions by replacing gas-driven pneumatic pumps with alternative pumps, including instrument air, solar-charged direct current (DC) electric pumps, and standard alternating current (AC) electric pumps." (1) Our focus will be on the latter, assuming that electricity is already available at the producing site.

Gas-assisted vs. electric-driven pumps

In the natural gas production sector, there are tens of thousands of glycol dehydrators in use for the express purpose of removing water from the gas. Triethylene glycol (TEG) is typically the absorbent fluid used by glycol dehydration systems, and pumps are used to circulate TEG through the dehydrator. Operators purchase and

install two main types of circulation pumps: gas-assisted glycol pumps, also known as "energy-exchange pumps," and electric pumps, i.e. driven by an electric motor.

Gas-assisted pumps are the most common circulation pumps found in remote areas due in most cases to a lack of electrical power supply. These specially designed pneumatic gas-driven pumps operate as follows:

- Leverage energy of high-pressure, natural gas entrained in the rich (wet) TEG leaving the gas contactor.
- Use additional high-pressure wet production gas for mechanical advantage and, therefore, carries more methane-rich gas to the TEG regenerator, where it is vented with water boiled off of the rich TEG.
- Place wet, high-pressure TEG opposed to dry, low pressure TEG, separated only by rubber seals.

The downside is that worn seals result in contamination of the lean (dry) TEG, making it less efficient in dehydrating the gas, requiring higher glycol circulation rates. Typical methane emissions are about 1,000 cubic feet (Mcf) for each million cubic feet (MMcf) of gas treated.

By replacing gas-assisted pumps with electric pumps, system efficiency is increased and emissions greatly reduced. For example, a 10 MMcf per day dehydrator could save up to 3,000 Mcf of gas a year, worth $9,000.

EPA Methane Gas Emissions Standards, for the Oil & Gas Industry

In 2012, the EPA published 40 CFR Part 60 Subpart OOOO, more commonly known as Quad-O, which set forth substantial new methane emissions monitoring and reduction requirements, as well as provisions mandating that owners and operators in the oil and gas industry implement comprehensive leak detection and repair (LDAR) programs throughout their facilities.

The regulatory pressure is on

These standards have become increasingly more stringent. In 2016, the EPA published amendments to Quad-O, expanding the number of affected facilities and equipment types subject to the regulation, as well as new methane emissions standards, LDAR requirements, and additional reporting obligations. Affected facilities include all hydraulically fractured gas wells for which construction began on or after January 1, 2015, as well as all new or modified compressor stations, pneumatic controllers, and storage vessels in service throughout the natural gas production, processing, and transmission segments.

Quad-O also introduces new operating and maintenance requirements for emission control devices that are installed throughout the network of affected facilities. This includes: storage tank covers, wet seal degassing systems, closed-vent systems, bypass devices, enclosed combustion devices, vapor recovery units, and flaring systems. The control device requirements are intended to prevent waste of saleable gas, while also reducing emissions from those types of equipment. Affected facility owners and operators must install continuous parameter monitoring systems (CPMS) to demonstrate that control devices are achieving the **95 percent emissions reduction** targets established under the regulation, and thoroughly document control device operating parameters and performance. (2)

Benefits of Electric-Driven Glycol Pumps

The tightening of regulatory controls is motivation enough to move towards electric-driven glycol pumps. The Viking Pump line of external gear GL-407 Series™ and GL-410 Series™ offer a reliable pumping solution for circulation of TEG in natural gas glycol dehydration systems. These pumps deliver economic as well as environmental benefits, with gas savings and methane emission reductions being the primary benefits.

GL-41009 Pump
& Motor Unit

The following excerpt from an EPA bulletin (1) illustrates benefits to the environment, along with other positive factors:

Financial return on investment through reduced gas losses

Using electric-driven glycol pumps reduces methane emissions by a third or more. All of the wet production gas remains in the system to be dehydrated and sold as product. In many cases, the cost of implementation can be recovered in less than 1 year.

Increased operational efficiency

Worn O-rings in gas-assisted glycol pumps can cause contamination of the lean TEG stream in the dehydrator, reducing system efficiency and requiring an increase in glycol circulation rate, compounding the methane emissions. The design of electric pumps eliminates the potential for this contamination to occur and, thereby, increases the operational efficiency of the system.

Reduced maintenance costs

Replacing gas-assisted glycol pumps often results in lower annual maintenance costs. The floating piston O-rings in gas-assisted pumps must be replaced when they begin to leak, typically every 3 to 6 months. The need for this replacement is eliminated when electric pumps are employed.

Reduced regulatory compliance costs

The cost of complying with federal regulations of hazardous air pollutants (HAPs) can be reduced through the use of electric pumps. Dehydrator HAP emissions, including volatile organic

compounds such as benzene, toluene, ethyl benzene, and xylene (BTEX), are significantly lower in units powered by electric pumps.

Furthermore, electric-driven pumps are more reliable and require less maintenance than pneumatic pumps because they eliminate the use of wet lease gas and the downtime associated with freezing and corrosion. (3)

Calculating Emissions and Total Gas Savings

While benefits of electric-driven glycol pumps can be measured, it depends on the pump size, operating pressure, and the size and configuration of the pump installation. Essentially, the expected emissions savings due to an electric pump installation equals the amount of methane emissions that were being leaked from the gas-assisted pump being replaced. The quantity of avoided emissions can then be multiplied by the market price of gas to determine the total value of gas savings. (***Note:*** If the glycol dehydration unit has a flash tank separator, and a beneficial use for all gas recovered, then the gas savings might not, by itself, provide enough justification for installing an electric pump.)

Conclusion

Installing electric pumps to replace gas-assisted glycol pumps can offer significant environmental, as well as operational and economic, advantages for operators of natural gas processing facilities. With the challenge of Quad-O compliance, in particular, it makes good sense for oil and gas companies to switch to the preferred pump technology in cases where there is available electricity.

The following trends are driving the market in the direction of electric-driven glycol pumps:

- Eliminate wasted/flared gas – results in less burning of associated gas
- Reduce emissions – for improved safety and less pollution from methane
- Desire for remote monitoring –- increasing the motivation for electricity at well sites

For more information, contact Viking Pump directly, or one of our distributors, to request a Glycol Dehydration Pump flyer. Or visit the website at www.vikingpump.com.

References

(1) *Replacing Gas-Assisted Glycol Pumps with Electric Pumps*, Natural Gas STAR Partners Lessons Learned, United States Environmental Protection Agency, October 1, 2018.

(2) *Quad-O: EPA's Methane Emissions Standards for the Oil and Gas Industry*, Velocity EHS Blog, 2/17/2017, https://www.ehs.com/2017/02/quad-o-epa-methane-emissions-standards-oil-gas-industry.

(3) *Convert Natural Gas-Driven Chemical Pump*, Partner Reported Opportunities (PROs) for Reducing Methane Emissions, Fact Sheet No. 202, United States Environmental Protection Agency.