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Best Practices for Using Flares to Meet Proposed EPA Emissions Regulations for Hydraulically Fractured Natural Gas or Oil Wells

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Abstract

The new 2012 EPA Oil and Natural Gas Air pollution standards, enacted April 17, 2012, are designed to reduce harmful emissions of VOCs from hydraulically fractured wells. VOCs in the presence of sunlight promote the formation of smog (grade-level ozone) near areas where oil and gas production occurs. The four-targeted areas of VOC reduction in oil and gas production will affect some 25,000 wells per year as well as storage tanks and other processing equipment. Flare systems are proposed as one of the preferred control devices to meet these new regulations.

Complicating the hydraulic fracturing production picture further, the industry expects new EPA flare regulations to be proposed shortly. These regulations are currently under review with public comment underway via the TCEQ and EPA Flare Stakeholder Task Force.

This paper will address specifics of both new regulations and provide guidance for cost-efficient and effective flare system designs.

Introduction

On April 17, 2012, the US Environmental Protection Agency (EPA) released final environmental regulations to reduce air pollution from the oil and gas industries. The final ruling, the result of an eight-year review of the EPA's Clean Air Act, includes the first federal air standards for oil and natural gas production. After final comments were received, a New Source Performance Standards (NSPS) for VOC and SO_2 reduction at the well site, and a National Emissions Standards for Hazardous Air Pollutants (NESHAP) for oil and gas production facilities were developed. The final ruling provides well owners and operators increased compliance flexibility while enhancing transparency and accountability. The new regulations will also help well operators avoid unnecessary spending of state and private resources and maintain comparable environmental benefits.

One of the key components of the new ruling is reducing the potent greenhouse gases that result from natural gas production. Forty percent of all greenhouse gas emissions occur from oil and gas production and processing; gas production and processing is one of the single largest methane sources.[1] Reducing the VOC emissions from production equipment and well sites will help reduce ground-level ozone. This final ruling is "expected to yield a nearly 95% reduction in methane and VOCs emitted from more than 11,000 new hydraulically fractured gas wells each year.[1]" VOCs in the presence of sunlight promote the formation of smog (ground level ozone), a known irritant with potential health and environmental impacts near oil and gas production sites. Crude oil and gas production as well as natural gas onshore processing are targeted segments for VOC and SO_2 reduction. Other emissions, including benzene and other known potential air toxins, are also defined.

40 CFR Part 63 subpart HH directly impacts the oil and gas production industry. Subpart HHH of regulation 40 CFR Part 63 specifically affects the natural gas transmission and storage market segment. In previous rulings, Startup, Shutdown, and Malfunction (SSM) activities were exempted from meeting performance standards during these specific periods of operation. In the new regulations, SSM is not exempt and is required to meet the noted performance standards. This is a departure from previous regulations and should be a consideration in the design of control devices.

The new ruling incorporates five source categories of oil and gas production:

NATCS Code
211111- Crude Petroleum and Natural Gas Extraction
211112- Natural Gas Liquid Extraction
221210- Natural Gas Distribution
486110- Pipeline Distribution of Crude Oil
486210- Pipeline Transportation of Natural Gas

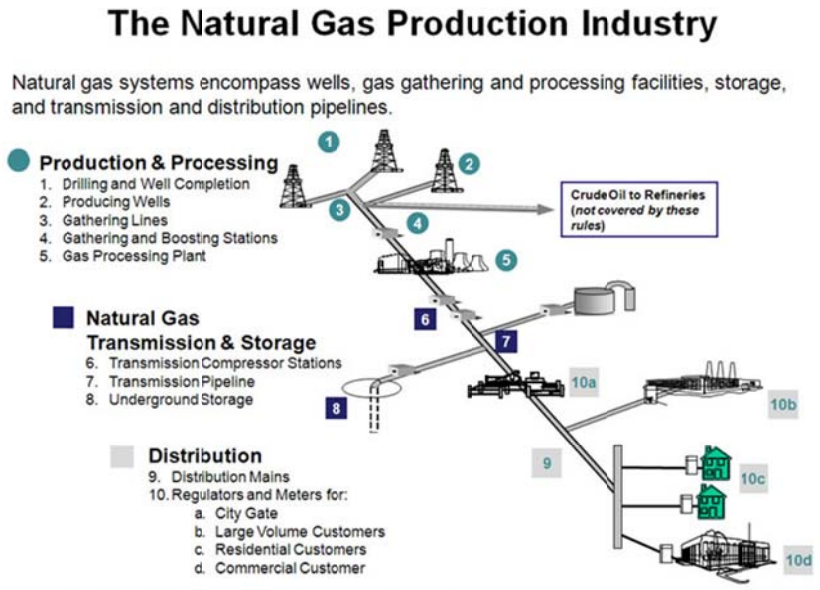

Figure 1. The Natural Gas Production Process Diagram adapted from the American Gas Association and the EPA Natural Gas STAR Program

EPA Regulations Affecting Upstream Operations

Standards for Natural Gas Well Operations

Affecting newly fractured or refractured natural gas wells after August 23, 2011, the NSPS require reduced VOC emissions by 95% during completion flowback activities. The rule requires hydraulically fractured gas wells use Reduced Emission Completion (REC), otherwise known as green completion, to reduce VOC emissions during the flowback period. Green completion is not required until January 1, 2015. For applications where REC is not a technically feasible option (Exploration, Delineation, LP wells), a Completion Combustion Device (CCD) may be one of the preferred options. In order for a CCD to be applicable, CCDs must have reliable ignition sources over the duration of the flowback period (typically 3-10 days) and must meet 95% VOC reduction. For those operators with multiple drilling sites in a condensed geographical area, the use of a portable CCD might be an option to consider. Open or enclosed portable well production flares can increase flexibility to address multiple well sites without any foundation requirement and allow for management of multiple well sites.

Standards for Storage Tanks

The NSPS initially defined a storage tank as a vessel or series of vessels having VOC emissions equal to or greater than 10 tons per year. The final ruling limits storage tanks to a VOC emissions level of six tons per year. This is a significant change from the initial drafting of the ruling. Storage tanks have one year or until April 17, 2013, to install necessary controls. Storage tank operators may have an additional 30 days to measure VOC to determine if controls are required on new tanks and an additional 30 days to set and install necessary controls in place. A 95% VOC reduction efficiency is required.

If a flare is utilized to achieve the 95% VOC reduction, and the flare is designed per SS 60.18b, there is no requirement for rigorous performance testing either in the field or at the flare provider's facility, and only compliance testing per Method 22 from 40 CFR Part 60, Appendix A-7 is required. The flare will require a standing pilot and heat sensing monitoring with a recording device to indicate continuous ignition of the pilot flame.
Per NESHAP review, large and small dehydration units at major sources require a 95% reduction in benzene emissions. New units must comply on startup and already existing applications are required to comply within three years, or April 17, 2015.

Flare systems specifically designed for glycol dehydration vents are available and can easily achieve the 95% VOC reduction mandated.

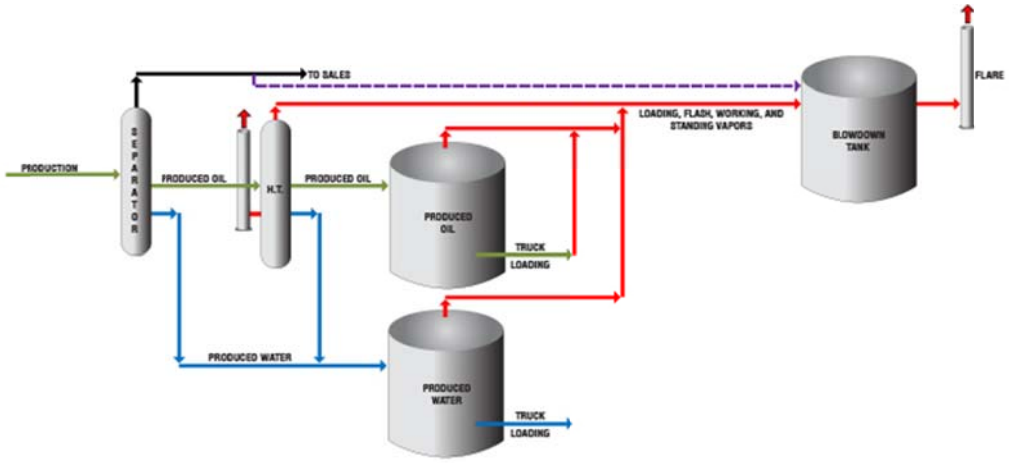

Figure 2. Wellpad Process Flow Diagram

Natural Gas Gathering and Boosting Stations

The final ruling limits storage tanks in natural gas gathering and boosting stations to a VOC emissions level of six tons per year. This is a significant change from the initial drafting of the ruling. Storage tanks have one year or until April 17, 2013, to install necessary controls. Storage tank operators may have an additional 30 days to measure VOC to determine if controls are required on new tanks and an additional 30 days to set and install necessary controls in place. A 95% reduction in VOC is required. A properly designed flare system will easily achieve and meet the 95% reduction required when using the flare as a CCD.

NSPS as well as NESHAP require the control of centrifugal and reciprocating compressors, rod packing replacement and pneumatic controller vents. Under the new regulations, the compressors are required to meet emission reductions, necessary replacements, initial performance testing, and recorded annual reports. Beyond the new NSPS and NESHAP requirements, further pending regulations are likely to impact flares for these facilities.

The EPA has continued research the Texas Commission on Environmental Quality (TCEQ) initiated regarding highly reactive VOC reduction in flare systems. The Flare Task Force section of the TCEQ website gives additional details on this effort (http://www.tceq.texas.gov/airquality/stationary-rules/stakeholder/flare_stakeholder.html). These forthcoming regulations will likely require additional controls for the assist media being utilized for smokeless operation, typically steam or low pressure air blowers. It is also likely to be required that the steam or air to be in a particular ratio to the amount of hydrocarbon being flared, so that the flare can not be operated in a “over steam” or “over air” condition, to the point of quenching the flame and producing excessive VOC emissions.

While those regulations have not been published as of the date of this manuscipt, the affected facility operators need to remain aware of both the already published new and the likely upcoming regulations and consider potential flare designs that would meet requirements for forthcoming new facilities. To address glycol dehydration vent VOC reduction, flare systems are specifically designed for these applications and are able to achieve the 95% VOC reduction mandated.

Gas Processing Facility

The final ruling limits storage tanks at Gas Processing facilities to a VOC emissions level of six tons per year. This is a significant change from the initial drafting of the ruling. Storage tanks have one year or until April 17, 2013, to install necessary controls. Storage tank operators may have an additional 30 days to measure VOC to determine if controls are required on new tanks and an additional 30 days to set and install necessary controls in place. A 95% reduction in VOCs is required. A properly designed flare system for gas processing facilities can easily achieve these requirements.

NSPS as well as NESHAP require the control of centrifugal and reciprocating compressors, rod packing replacement and pneumatic controller vents. Under the new regulations, the compressors are required to meet emission reductions, necessary replacements, initial performance testing, and recorded annual reports. Beyond the new NSPS and NESHAP requirements, further pending regulations are likely to impact flares for these facilities.

The EPA has continued research the Texas Commission on Environmental Quality (TCEQ) initiated regarding highly reactive VOC reduction in flare systems. The Flare Task Force section of the TCEQ website gives additional details on this effort

(http://www.tceq.texas.gov/airquality/stationary-rules/stakeholder/flare_stakeholder.html). These forthcoming regulations will likely require additional controls for the assist media being utilized for smokeless operation, typically steam or low pressure air blowers. It is also likely to be required that the steam or air be in a particular ratio to the amount of hydrocarbon being flared, so that the flare can not be operated in a “over steam” or “over air” condition, to the point of quenching the flame and producing excessive VOC emissions.

While those regulations have not been published yet, the affected facility operators need to remain aware of both the already published new and the likely upcoming regulations and consider potential flare designs that would meet requirements for forthcoming new facilities.

Gas processing facilities have important NESHAP regulations to note regarding leak detection and repair. For sweetening units over five long tons per day (ltpd) of SO2, the units are required to meet the reduction of 99.9%. For large and small dehydration units located at major sources, a required 95% reduction in benzene emissions must be met upon startup on newer small units, and existing small dehydration units must comply within 3 years or April 17, 2015. To address glycol dehydration vent VOC reduction, flare systems are specifically designed for these applications and are able to achieve the 95% VOC reduction mandated.

Gas Compressor Stations

For gas compressor stations, the final ruling limits storage tanks to a VOC emissions level of six tons per year. This is a significant change from the initial drafting of the ruling. Storage tanks have one year or until April 17, 2013, to install necessary controls. Storage tank operators may have an additional 30 days to measure VOC to determine if controls are required on new tanks and an additional 30 days to set and install necessary controls in place. A 95% reduction in VOC is now required by NSPS. This emissions reduction can be easily achieved through the use of a properly designed flare system.

Per NESHAP review, large and small dehydration units at major sources require a 95% reduction in benzene emissions. New units must comply with the new regulations upon startup and already existing applications are required to comply within 3 years, or April 17, 2015. Beyond the new NSPS and NESHAP requirements, there is further pending regulations that are likelyto impact flares for these facilities.

The EPA has continued research the Texas Commission on Environmental Quality (TCEQ) initiated regarding highly reactive VOC reduction in flare systems. The Flare Task Force section of the TCEQ website gives additional details on this effort (http://www.tceq.texas.gov/airquality/stationary-rules/stakeholder/flare_stakeholder.html). These forthcoming regulations will likely require additional controls for the assist media being utilized for smokeless operation, typically steam or low pressure air blowers. It is also likely required that the steam or air to be ratioed to the amount of hydrocarbons being flared, so that the flare can not be operated in a “over steam” or “over air” conditions, to the point of quenching the flame and producing excessive VOC emissions

While these regulations have not been published as of the date of this manuscipt, the affected facility operators need to remain aware of new and upcoming regulations and consider potential flare designs that may impact forthcoming facilities. To address glycol dehydration vent VOC reduction, flare systems are specifically designed for these applications and are able to achieve the 95% VOC reduction mandated.

Using Flare Applications in Accordance with EPA Regulations

In order to utilize a production flare application as a CCD for completion flowback, the flare must have a reliable ignition source over the duration of the flowback period (typically 3-10 days) and be able to meet the required 95% VOC reduction. For those operators with multiple drilling sites in a condensed geographical area, the use of a portable CCD might be an option to consider. Open or enclosed portable well production flares can increase flexibility to address multiple well sites without any foundation requirement and allow for management of multiple well sites in a field to manage flowback schedules. Production flares are able to operate in difficult environments and are typically located in unmanned locations. Combustion companies such as Zeeco, Inc., understand the regualtory landscape and resulting design features to incorporate into current designs for custom applications.

Storage vessel vents do not require performance testing if it is designed and operated per 60.18b with compliance demonstration using Method 22 from 40 CFR Part 60, appendix A-7, to determine visible emissions. The flare will require a standing pilot, and heat sensing monitoring with a recording device that indicates the continuous ignition of the pilot flame.

To address glycol dehydration vent VOC reduction, flare systems are specifically designed for these applications and are able to achieve the 95% VOC reduction mandated.

The proposed regulations are designed to reduce harmful emissions of VOCs from hydraulically fractured wells. VOCs in the presence of sunlight promote the formation of smog (grade-level ozone) near areas where oil and gas production occurs. The four targeted areas of VOC reduction in oil and gas production will affect some 25,000 wells per year as well as storage tanks and other processing equipment. Flare systems are proposed as one of the preferred control devices to meet these new regulations.

With the increasing exploration of shale formations around the globe, it is important to make the right decision when choosing a combustion device. As of this writing, the aforementioned regulations are the final regulations and should be considered when designing a combustion device to meet the necessary production needs.

References

[1] ***Overview of Final Amendments to Air Regulations for the Oil and Natural Gas Industry Fact Sheet*. 2012.** United States Environmental Protection Agency (EPA). <http://www.epa.gov/airquality/oilandgas>.