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Flare Gas and 40 CFR 60 Subpart OOOO

STORAGE VESSELS APPROACHING QUAD O DEADLINE

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This paper supplements the Sage Metering white paper, “Flare Gas Measurement Using Thermal Mass Flow Meters,” by Bob Steinberg, dated July 2013.

Background

“Flare Gas Measurement Using Thermal Mass Flow Meters” explains how flare gas and vent gas systems around the world, burn off waste gases, dispose of surplus gases and protect people, equipment, and the environment. Flare gas systems are operational in oil and gas production, refining, chemical processing, gas plants, wastewater treatment facilities and landfills. The measurement and monitoring of flare gas are necessary to ensure the combustion device system is operating correctly.

Additionally, stringent environmental regulations often require the measuring of flare gas to the atmosphere. The 2013 white paper discusses the inherent challenges associated with measuring and monitoring flare gas, such as substantial flow variation, potential for changing gas composition and working in hazardous locations. The publication reveals how thermal mass flow meters provide solutions for flare gas measurement and monitoring in many applications.



There are regulations worldwide providing guidelines to the operation of combustion devices. In the United States, the Environmental

Protection Agency (EPA) requires the measurement, recording and reporting of flare gas emitted to the atmosphere. That guideline is the Mandatory Reporting of Greenhouse Gases Rule EPA 40 CFR 98.

New Source Performance Standards

“Section 111 of the Clean Air Act authorized the EPA to develop technology-based standards which apply to specific categories of stationary sources. These standards are referred to as New Source Performance Standards (NSPS) and are found in 40 CFR Part 60. The NSPS apply to new, modified and reconstructed affected facilities in specific source categories such as manufacturers of glass, cement, rubber tires and wool fiberglass. As of 2005, there were approximately 75 NSPS.

The NSPS are developed and implemented by EPA and are delegated to the states. However, even when delegated to the states, EPA retains authority to implement and enforce the NSPS.”¹

What is EPA 40 CFR 60 Subpart OOOO (Quad O)?

EPA 40 CFR 60 involves the standards of performance for new stationary sources. Subpart OOOO applies to performance standards pertaining to crude oil and natural gas production, transmission and distribution. EPA 40 CFR 60 Subpart OOOO, also known as Quad O, is the mandate which includes emission standards and compliance schedules for the reduction of volatile organic compounds (VOC) and SO₂ emissions from facilities that began construction or had modifications or renovations, after August 23, 2011. View this document on [eCFR – Code of Federal Regulations](#)^a.

Quad O applies to numerous areas in oil and gas production including oil and gas wells, (during hydraulic fracturing), vents from storage tanks, centrifugal compressors with wet seals, equipment leaks and continuous bleed pneumatic controllers. A significant portion of Subpart OOOO (Quad O) deals with the emissions from storage vessels in the oil and natural gas production areas, natural

gas processing plants, natural gas transmission facilities and in storage areas.



The EPA defines a *storage vessel* as a tank or container that contains crude oil, condensate, intermediate hydrocarbon liquids, or produced water. The storage vessels can be located anywhere from the oil well to where the oil is transferred to transmission pipelines. In natural gas production and transmission, tanks may be used right up to the point where the gas arrives at the distribution system. The EPA projects that as many as 46,000 new or recently modified storage tanks need to be compliant with EPA 40 CFR 60 Subpart OOOO by April 15, 2015, or when the tank is first placed into service.

Storage Tank Control Threshold

The EPA has imposed a minimum emission threshold of six tons per year (tpy) of VOCs for storage vessels. Thus, any vessel emitting more than six tpy is subject to these regulations. An emission of six tpy of methane is a very low flow rate; approximately 25 - 30 SCFH. Storage tanks with VOC emissions less than six tpy do not require control. The user must demonstrate that the uncontrolled emissions are less than six tpy on a monthly basis. If the flow rate increases to six tpy then a control system to reduce VOC emissions from the tank by 95% must be installed.

Storage Vessels and Centrifugal Compressors

To reduce the VOC emissions from storage tank vents and the vent from centrifugal compressors with wet seals, Quad O requires using a combustion device (flare, combustor or thermal

oxidizer) to destroy the VOCs. Optionally, a vapor recovery device (e.g., carbon adsorption system or condenser) or other non-destructive control devices can be used.² The regulations permit other methods of reducing VOC emissions; however a combustion device appears to be the most prevalent method utilized.

Performance Testing for Combustion Control Devices

The regulations require that the combustion control devices, being used at a storage vessel or centrifugal compressor, demonstrate compliance with Quad O requirements. The control devices must remove (or destroy) a minimum of 95% of the VOCs.



Some combustion device manufacturers have opted to conduct extensive performance testing to prequalify that their equipment will meet the EPA's Quad O requirements (section 60.5413(d)). The testing includes

determining the gas flow rate range of the combustor where at least 95% combustion of the VOCs is obtained. Without the end user acquiring a prequalified unit, with the manufacturer's certification, the user needs to conduct extensive performance testing after installation.

Continuous Monitoring Requirements

For the user that installs a combustion control device which has been tested and approved by the EPA to meet the performance requirements, the installation of a continuous monitoring system is required. This system ensures that the combustion control device is operating within the parameters established during the original performance testing. A continuous monitoring system includes:

1. A flow meter to measure the gas flow rate at the inlet of the combustion control device. The accuracy of the flow meter will be +/- 2% or better.
2. A monitoring device to verify the continuous presence of the pilot flame.

The manufacturer's performance testing determines flow rates where 95% removal of the VOCs is obtained. During the operation, the user must continually measure the flow rate to the combustion unit to ensure that the actual flow rate is within the operational range established during the performance testing and approved by the EPA. Any deviation where the actual flow rate is above or below the established range must be reported.

Thermal mass flow meters are an ideal product to measure the gas flow rate to the combustion device. They

Sage Prime



provide a direct mass flow measurement without the need for temperature or pressure correction, high turndown capabilities permitting service over a very broad operation range, easy installation, and extremely low pressure drop with high reliability.

Natural Gas Emissions at the Wellhead

Quad O requirements also address natural gas emissions at the wellhead during hydraulic fracturing (fracking) operations. In general, all sellable natural gas must be directed to the pipeline as soon as feasible. Until that time, the gas may be re-injected or used as a local fuel source. Direct release of the gas to the atmosphere must be minimized, and any discharge must go to a combustion device. The combustion device requirements for natural gas from fracking are more stringent than for storage tanks or compressor seals, since nearly-complete combustion is required (as opposed to 95%).



For monitoring and record keeping, the user is required to monitor the time (in hours) that the combustion device is operating. Additionally, the facility is required to record the location of the well, API well number, duration of flowback, period of recovery to the flow line, length of combustion and venting, and specific reasons for venting (rather than capturing or combustion). There is no requirement for flow monitoring at the wellhead.

Schedule of Requirements and Deadlines

When do facilities need to comply with EPA 40 CFR 60 Subpart OOOO? Please note that there have been numerous revisions to this regulation, but as of the date of this paper, the following statements are accurate:

- Subpart OOOO only applies to facilities constructed, modified or reconstructed after August 23, 2011. (60.5365)
- With the exception of storage vessels, compliance is no later than October 15, 2012 or on startup. (60.5370)
- Storage tanks constructed between August 23, 2011 and April 12, 2013, must be in compliance by April 15, 2015. These vessels are considered Group 1 tanks. (60.5395)
- Storage tanks that come on-line after April 12, 2013 must have been in compliance by April 15, 2014 or 60 days after startup. These vessels are Group 2 tanks. (60.5395)
- These regulations also apply to any new installations or modifications to existing equipment or increase in production.

Alternative Emissions Limit

The EPA has established an alternative emission limit for storage vessels. The alternative limit allows owners/operators to reduce VOC emissions to 95% at a tank or demonstrate that the emissions have dropped to four tpy without emission controls.

To qualify for the alternative limit, the owner/operator must document that the uncontrolled tank emissions have been below four tpy for at least 12 consecutive months. Additionally, the owner/operator must re-evaluate emissions monthly and if the VOC emissions increase over four tpy rate at any time, the operator/owner must meet the 95% reduction requirement in 30 days. If the increase in emissions is associated with a fracture of a well, the owners/operators

must meet the 95% threshold when the liquids from the fractured well have been directed to the tank. (60.5395(d)(2))

Conclusion

For storage vessels emitting six tons per year of VOCs, the EPA requires a combustion device or recovery system to remove VOC emissions. The combustion device is recognized as the most-predominant tool to combust the VOCs. In this case, a continuous control monitoring mechanism is required to demonstrate Quad O compliance. This system requires a gas flow meter with 2% accuracy at the inlet of the control device. The EPA deadline is April 15, 2015 for Quad O compliance for Group 1 storage tanks built between August 2011 and April 2013.



The Sage Metering thermal mass flow meter is ideal to support those needs for continuous control devices. For more information on the use of thermal mass flow meters in flare applications take a look at the Sage Metering white paper, [Flare Gas Measurement Using Thermal Mass Flow Meters](#)^b.

If you need assistance with designing a thermal mass flow meter for an application, we welcome you to call us at (866) 677-7243. Also visit our [Build-a-Meter](#)^c, an innovative interactive website tool that can be used to design a flow meter for a particular application.

References

¹*New Source Performance Standards and State Implementation ...* (n.d.). Retrieved from <http://www.epa.gov/compliance/monitoring/programs/caa/newsources.html>

²Environmental Protection Agency - U.S. Government Printing ..., http://www.gpo.gov/fdsys/pkg/FR-2013-04-12/pdf/2013-07873.pdf_br (accessed August 12, 2014).

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^a <http://tinyurl.com/3CFR-Code-of-Federal-Regulation>

^b <http://tinyurl.com/flare-gas-TMFM>

^c <http://sagemetering.com/build-a-meter/>



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