Understanding a New Regulatory Environment

Blake Leary

Regional Manager

Zeeco, Inc.

Ron M. Clark, P.E.

International Business Development Manager

Sage Environmental Consulting, L.P.

Presented at the 2014 GPA Convention

April 13-16, Dallas, TX, USA

Abstract

On April 17, 2012, following an eight year review process of the Clean Air Act, the U.S. EPA finalized and issued the first federally enforceable air quality regulations and standards for the Oil and Natural Gas Industry. These regulations and standards were designed to reduce emissions of smog-forming volatile organic compounds (VOCs), along with other Hazardous Air Pollutants (HAPs). After final comments of the newly proposed regulations were considered, the EPA released the New Source Performance Standards 40 CFR, Part 60, Subpart OOOO (NSPS OOOO or NSPS 4O) and updates to the National Emissions Standards for Hazardous Air Pollutants (NESHAP) 40 CFR, Part 63, Subparts HH, and HHH (HH/HHH) for the oil and gas production, transmission, distribution, and processing industries. These regulations originally published on August 16, 2012 in the Federal Register. The most recent revisions to the NSPS OOOO regulations were published in the Federal Register on September 23, 2013 (FR 58416). These revisions addressed the first round of petitions filed by the American Petroleum Institute (API) and others for reconsideration; however, this revision mostly addressed the questions surrounding storage tanks and the control device provisions of the rule.

The EPA is expecting that all affected facilities comply with these regulations by installing a combustion control device that meets a 95% reduction. This applies to both HAPs and VOC emissions from hydraulically fractured gas wells, storage tanks, transmission, transportation, and processing equipment in the U.S. Oil and Natural Gas Industry. Flare systems, vapor recovery units, and enclosed combustors are the most common types of control devices that can be installed to meet the requirements of these new regulations. Ms. Blake Leary of Zeeco, Inc., in conjunction with Mr. Ron M. Clark, P.E. of Sage Environmental Consulting, L.P., will address the specifics of these new regulations, and provide guidance for upstream and midstream owners and operators in selecting the most cost-efficient and effective control systems available to meet these requirements.

Introduction

As the first federal air standards for oil and natural gas begin to roll into effect, upstream and midstream operators need to be aware of the cost-effective technology and practices necessary to achieve the required VOC and HAP emissions reductions for hydraulically fractured natural gas wells. The regulations are "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]" Based on recent figures, the EPA has drastically underestimated the counts of new hydraulically fractured wells. Crude oil and natural gas production, transmission, distribution, as well as onshore natural gas processing, are also targeted industry segments for greenhouse gases (GHGs), VOCs and HAPs reductions.

Certain GHGs, VOCs, and HAPs 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 and processing sites. Reducing these emissions from initial well completion, production, and distribution, to processing and production on the well pad sites will help reduce ground-level ozone concentrations, and subsequently increase air quality in surrounding areas.

Forty percent of U.S GHG emissions occur from oil and natural gas production and processing; furthermore, natural gas production and processing is one of the single largest methane sources.[1] NSPS OOOO and NESHAP Subpart HH specifically regulate the oil and gas production industry, while MACT Subpart HHH regulates the natural gas transmission and storage market segment. By enacting stricter standards on the transmission and distribution from the production site to the processing facilities, the EPA hopes to curb GHG emissions from these segments.

An example of these stricter standards as it relates to Startup, Shutdown, and Malfunction (SSM/MSS) activities, in previous regulations or Permit by Rule (PBRs) requirements, MSS related activities were exempt from meeting emissions controls, or performance standards during these specific periods of operation in certain areas of the U.S. In the new Federal and even State Regulations (i.e. the new Texas Commission of Environmental Quality (TCEQ) MSS Regulations) MSS is not completely exempt and is required to meet the mandated performance standards, as well as developing an MSS Procedure and Plan to prevent this same incident from

re-occurring. This is a departure from previous regulations and should be a consideration in the design of implemented control devices.

EPA Regulations Affecting Upstream and Midstream Operations

In order to understand how the EPA NSPS OOOO and NESHAPS HH and HHH have been applied, Figure 1 breaks down seven (7) affected facilities over six (6) oil and gas industry segments.

Affected Facilities	Natural Gas Production Sites	Crude Oil Production Sites	Gathering & Boosting Stations	Natural Gas Processing Plants	Natural Gas Transmission & Compression	Underground Natural Gas Storage
Gas Wells	X					
Centrifugal Compressors			X	X		
Reciprocating Compressors			X	X		
Pneumatic Controllers	X	X	X	X		
Storage Tanks	X	X	X	X	X	X
Fugitive Components				X		
Natural Gas Sweeteners				X		

Figure 1. Simplified List of Affected Facilities per Industry Category

The regulatory requirements for each "affected facility" type do not apply to each industry sector. To highlight the requirements that apply to control devices, the remainder of this paper will focus on the sections of the rule that typically require a 95% emissions reduction control requirement.

Revised Standards for Storage Tanks

NSPS OOOO initially defined an "affected facility" Storage Tank, as a vessel, or series of vessels having VOC emissions equal to or greater than 10 tons per year. The final rule, amended August 2, 2013, requires a 95% emission reduction requirement for all "affected facility" Group 1 storage tanks located at production well-sites, gathering and boosting stations, processing facilities, compressor stations and storage facilities if the VOC potential to emit emissions for "each" storage tank that is greater than 6 tons per year. This is a significant change from the initial drafting of the regulation(s). The revised regulation defines an "Affected Facility" Group 1 Storage Tanks, as storage tanks constructed between August 23, 2011, through April 12, 2013, and obtain a potential to emit (PTE) of >6TPY of VOCs, or is not governed under a current State Permit or PBR, which already regulates the emissions of the Tank(s) below 6TPY. Group 1 tanks have until April 15, 2015 to install the necessary controls. Group 2 storage tanks as defined as storage tanks constructed after April 12, 2012, have until April 15, 2014 to meet the emission reduction requirements. Group 2 storage tanks and storage tanks constructed after April 15, 2014, must comply within 30 days of startup, estimate the tanks potential emissions, and determine whether the tank is greater than 6 tons per year and subject to the control requirements. Storage tank operators then have an additional 30 days to set and install necessary controls. Storage tank are not subject to the rule if it is determined that the emissions are less than 4 tons per year. Storage tanks that are initially subject to the rule and subsequently emit less than 4 tons per year for 12 consecutive months are no longer subject to the control standards but are still subject to the recordkeeping and reporting requirements (once in, always in). If there is a change to the operation of the well and storage tank that increase the emissions back above 4 tons per year, the tank must then again meet the 95% emission reduction requirement.

Well pad flares may be designed to cover both low pressure vents associated with flash gas from the storage tanks and high pressure gas from initial separation (See Figure 2). If a flare is utilized to achieve the 95% VOC or HAP reduction, then the flare must meet NSPS §60.18b. There is no requirement for rigorous performance testing either in the field or at the flare provider's facility, rather only compliance testing per Method 22 from 40 CFR Part 60, Appendix A-7 is required. The flare is also required to have a "standing pilot", or continuous ignition of the pilot's flame.

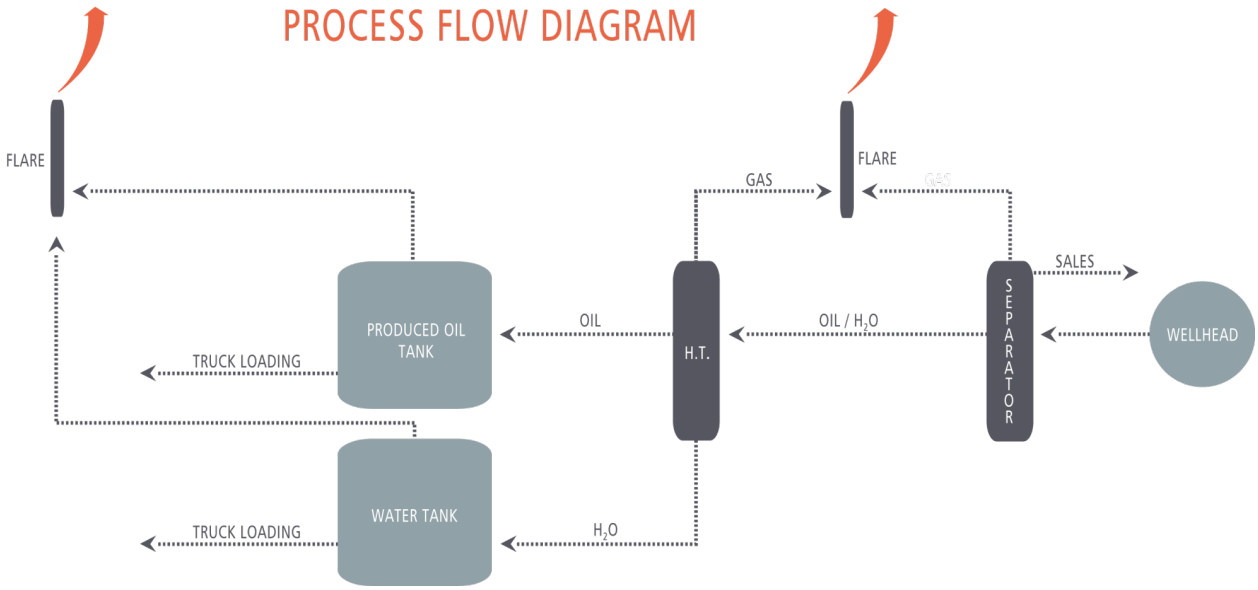

Figure 2: Wellpad Process Flow Diagram

Standards for Glycol Dehydrator Units

Depending on size and location, Glycol Dehydrator Units as shown in Figure 3 below, are required to meet one of two standards.

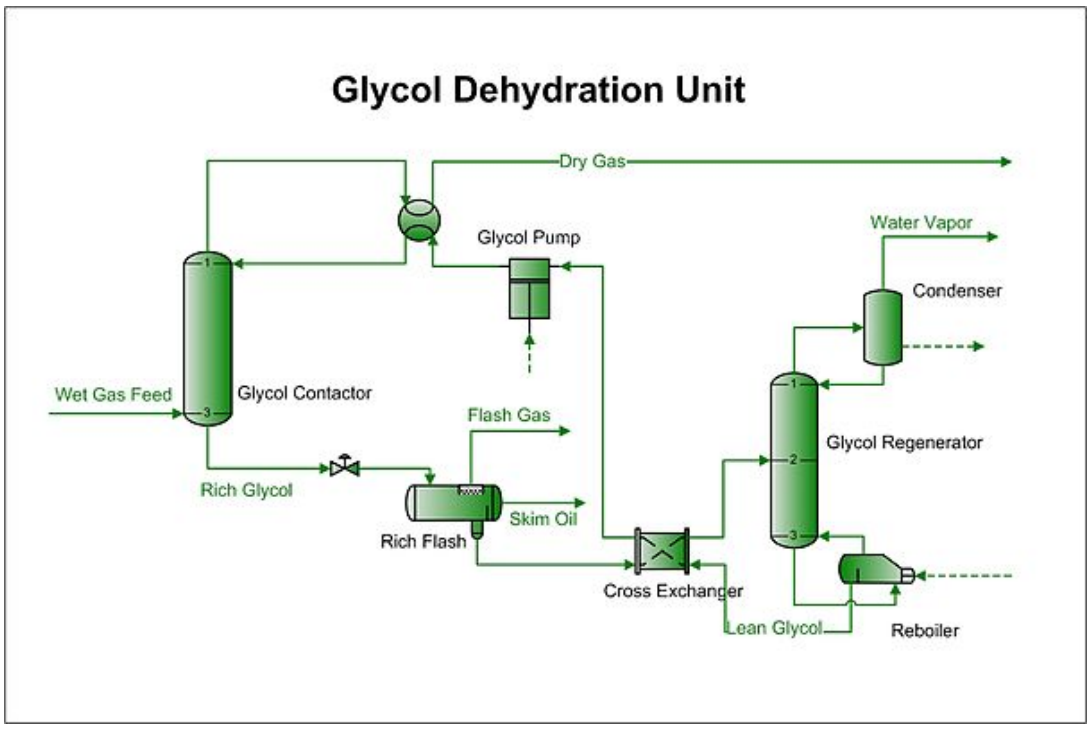

Figure 3: Glycol Dehydration Unit Flow Chart

NESHAP Subpart HH for Oil and Natural Gas Production Facilities distinguishes between "Large" and "Small" glycol dehydration units. Large units are defined as units that process >85,000 standard cubic meters per day and emit greater than 1 tpy benzene. Both new and existing small glycol dehydrators at major sources must meet the unit-specific BTEX (benzene, toluene, ethylbenzene and xylene) limit for emissions that is based on the unit's natural gas throughput and gas composition.

Newly constructed "small" glycol dehydrators (dehy), built after August 23, 2011, must meet the exemption requirement to demonstrate the gas throughput is less than 85,000 standard cubic meters per day or emit less than 1 tpy benzene. To ensure compliance, this exemption demonstration should be reviewed and documented on an annual basis. If the small dehy does not meet the emission control exemption, the unit must meet the control standards upon startup. Existing small glycol dehydrators are required to comply by October 15, 2015.

NESHAP HHH for Natural Gas Transmission and Storage Facilities also distinguishes between "Large" and "Small" glycol dehydration units. Large units are defined as units that process >283,000 cubic meters of gas per day and emits greater than 1 tpy benzene. Large glycol dehydrators are subject to NESHAP Control Requirements and have limited options for compliance strategies. Small units must control outlet benzene emissions to the limit calculated using a specified equation in the rule.

Per NESHAP review, large and small dehydration units at major sources require a 95% reduction in benzene emissions. New units must comply upon startup and already existing applications are required to comply within three years or April 17, 2015.

Standards for Natural Gas Well Operations

Affecting newly hydraulically fractured or re-fractured natural gas wells after August 23, 2011, the NSPS OOOO requires VOC emissions during flow-back to be reduced by 95% during well-completion flowback activities. The rule requires hydraulically fractured gas wells use Reduced Emission Completion (REC), otherwise known as green completion, to collect and route VOC emissions to sales pipelines as soon as possible during the flowback period. The deadline for the required REC is January 1, 2015. For applications where REC is not a technically feasible option (Exploration, Delineation, Low Pressure 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.

Natural Gas Gathering and Boosting Stations

Natural gas gathering and boosting stations are subject to the revised storage tank rules and NESHAP HH as described above. In addition, there are two more facilities that are affected: 1) Centrifugal and reciprocating compressors and 2) Pneumatic controllers. Under the regulations, compressors are required to meet emission reductions, necessary replacements, initial performance testing, and recorded annual reports. Emissions from centrifugal compressor wet seals must already meet a 95% reduction via a closed vent system and control device. Flares continue to be a viable option to meet this control requirement. Reciprocating compressors have a rod packing replacement requirements and will not require additional controls. The rod packing must be replaced at a minimum of every 26,000 operating hours or every 36 months. High continuous bleed pneumatic controllers with a bleed rate of greater than 6 scfh may only be used if the functional needs require a high bleed for safety or response time reasons. Otherwise, low bleed continuous or intermittent pneumatic controllers are not subject to the rule and have no control requirements.

Natural Gas Processing Plants

In addition to the revised storage tank rules, compressor requirements, and NESHAP HH requirements for glycol dehydrators described above, there are three additional requirements: 1) Pneumatic controllers must operate with a zero bleed rate, and 2) Fugitive emission sources must meet the requirements as prescribed by NSPS Subpart, KKK, KKKa, VV,VVa, etc.) Sweetening units over five long tons per day (ltpd) of SO_2 are required to meet the reduction of 99.9% for SO_2.

Natural Gas Transmission and Compression

In addition to the revised storage tank requirements, transmission and compressor stations must meet the requirements for large and small glycol dehydration units as described under

NESHAP HHH above. Figure 4 below demonstrates one example of a flare design located at a compressor station.

Figure 4: Variation of a Compressor Station Flare

Using Flare Applications in Accordance with EPA Regulations

With the upcoming regulations rolling into effect, upstream and midstream operators rely on engineered flare system designs with field-proven results. In order to utilize a production flare application as a CCD for completion flowback, the flare must have a reliable pilot and ignition source over the duration of the flowback period and be able to meet the required 95% VOC reduction.

The pilot should be designed to meet the American Petroleum Institute (API) 537 requirements, and all testing should meet industry standards to ensure the flare will meet environmental performance requirements such as:

- Stable flame in wind speeds of 150 MPH with 10 inches of rain per hour
- Ability to reignite automatically without operator interface or electric power
- Ability to monitor for the presence of flame and record for environmental records verification
- Continuous burning pilot flame, required by NSPS during "ALL" times of operation

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, as shown in Figure 5, 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.

Figure 5: Portable Flare

Production flares are able to operate in difficult environments and are typically located in unmanned locations. Combustion companies such as Zeeco, Inc., and environmental consulting

companies such as Sage Environmental Consulting, L.P., understand the regulatory landscape and incorporate design features into custom applications in any situation. Storage vessel vents controlled via a closed vent system to a flare do not require performance testing if the flare is designed and operated per NSPS §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; therefore requiring 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.

Beyond the oil and gas NSPS and NESHAP requirements, future federal, state, and local regulations are likely to impact flares for these facilities. New flare assist media regulations will target steam and air assist flares. The possible regulations will address Combustion Zone Net Heating Value (CZNHV), to reduce "over-steaming" or "over-aerating" flares. The amount of steam/air (via low pressure air blower), will have to be controlled in relationship to the amount of hydrocarbon being sent to the flare. It is worth noting, the EPA has reviewed the 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). Additional regulations will likely require controls for the assist media being utilized for smokeless operation, typically steam or low pressure air blowers.

When evaluating an engineered flare, seek a robust design that includes temperature-resistant construction for heat-affected components to ensure long-term life expectancy of the flare tip and pilot such as Zeeco's MJ flare series. Utilization of investment castings for the critical components in the heat-affected zones minimizes the potential for field failure. Requiring a continuous, monitored pilot that meets the API 537 performance design criteria (150 mph wind and 10" rain/hr), means less operation and maintenance issues in the field and ensures environmental performance.

While additional EPA and TCEQ regulations have not been published as of the date of this manuscript, 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.

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>.