

Introduction

Air pollutants are emitted into the atmosphere anytime you drive to work, ride a train, mow the lawn or grill outdoors. Similar types of air pollutants are emitted during natural gas production activities, such as drilling and hydraulic fracturing; completion and production activities; gas treatment and compression; and gas gathering and processing. Importantly, all sources of air emissions in the natural gas industry are subject to strict regulations written by the Environmental Protection Agency (EPA) under the authority of the federal Clean Air Act (CAA). States effectively implement these federal regulations, and in many cases, state and local governments place additional restrictions on air emissions resulting from natural gas production activities.

Drilling and Hydraulic Fracturing

Modern drilling and hydraulic fracturing is typically accomplished with the use of diesel engines. The emissions from these diesel engines are regulated by standards established by the EPA in the same manner that it regulates emissions from cars and trucks. Manufacturers of these engines are required to meet standards that are progressively more stringent for newer engines. Emissions from new diesel engines have been reduced by approximately 75% during the past decade and will be reduced another 90% from today's standards in the next five to six years.^{1,2}

KEY POINTS

- All sources of air emissions in the natural gas industry are subject to strict regulations written by the EPA under the authority of the federal CAA.
- States effectively implement these federal regulations.
- In many cases, states and local governments place additional restrictions on air emissions resulting from natural gas production activities.

Completion/Production Activities

Virtually all natural gas wells drilled today must be hydraulically fractured during completion to economically produce this premium, clean-burning fuel. This is particularly the case in tight reservoirs, such as deep shale. After the hydraulic fracturing process, fracturing fluids, which are comprised of more than 98% water and sand, are allowed to flow back to the surface for recovery. This is often referred to as cleaning up the well. The flowback period can last for hours or several days. Some natural gas flows back with the fracturing fluid, and this gas may contain volatile organic compounds (VOCs) such as propane. Each state has adopted state implementation plans (SIPs) that are approved by the EPA to ensure that minor and temporary sources of VOC emissions, such as well completions, do not cause or contribute to violations of federal air quality standards for ozone.³

In addition to these regulations, Chesapeake controls or reduces VOC emissions through a voluntary procedure called reduced emission completions or green completions.

A reduced emission completion can eliminate most of the VOC emissions and recover valuable natural gas during flowback and well testing.⁴ Reduced emission completions are not available for every well that is drilled and completed. A reduced emission completion requires special equipment and the installation of a natural gas gathering line and sales meter prior to well flowback and testing, which is not possible on all wells.



A typical natural gas wellsite may have a two-phase separator that is used to separate produced water from natural gas. In that case, the produced water is stored on-site until removed by truck and little, if any, VOCs are emitted from the stored water. When wells produce natural gas that is richer – contains heavier hydrocarbons, such as propane, butanes, pentanes, etc. – the wellsite may have a three-phase separator called a heater treater, which separates produced water, oil/condensate and natural gas. In this case, the oil/condensate is also stored on-site until it is removed by truck.

VOCs may be emitted from storage tanks that store the oil/condensate and vent to the atmosphere. Each state has rules that determine how much VOCs may be emitted before an air quality permit is required and/or before equipment such as a flare or vapor recovery unit (VRU), must be used to control emissions. Chesapeake prefers to use a VRU to reduce VOC emissions and recover valuable natural gas.⁵

Gas Treatment/Compression

Many wellsites have a small tri-ethylene glycol dehydrator unit, which is equipment that removes water from natural gas to meet gas pipeline specifications. These units are subject to very stringent EPA regulations known as National Emissions Standards for Hazardous Air Pollutants (NESHAP). Potential emissions of hazardous air pollutants, such as benzene, must be very low or equipment must be added to control these emissions.⁶

Occasionally, a natural gas well will require a small wellhead gas compressor to raise the pressure



to the gathering line's required pressure. These compressors are typically powered by natural gas-fired engines. The engines on these compressors are subject to EPA regulations known as New Source Performance Standards (NSPS), which limit the amount of nitrogen dioxide (NO_x) and VOCs that can be emitted.⁷ The engines

are also subject to strict NESHAP regulations to control emissions of hazardous air pollutants such as formaldehyde.⁸

Gas Gathering

Gas gathering is a process by which the natural gas produced from multiple wells is gathered into a pipeline system and transported to a gas compressor station that allows the gas to be marketed. A compressor station consists of one or more large compressors that boost pressure so that gas can flow to a user or a local distribution company, such as your local natural gas utility company. The natural gas-fired engines that drive these compressors are subject to the same EPA regulations that were previously discussed.^{7,8}

Many states have additional emission standards for these large engines. For instance, in the Dallas/Fort-Worth Nonattainment Area, which covers nine counties in North-central Texas, natural gas-fired compressor engines are subject to an emissions standard for NO_x that is twice as stringent as the current NSPS regulation.⁹

Dehydration units may also be located at compressor stations. These are subject to the EPA regulations previously discussed.⁶ Any hydrocarbon liquids that condense after the gas is compressed to higher pressures and cooled are separated and may be stored in tanks that vent to the atmosphere. Potential VOC emissions from these tanks are subject to various state limits and NESHAP regulation.

Gas Processing

After dehydration, lean natural gas – containing little, if any, heavier hydrocarbons such as propane, butanes, pentanes, etc. – will typically go straight to large gas transmission lines to be transported to markets. However, rich natural gas will typically be processed to condense and remove the heavier hydrocarbons, known as natural gas liquids (NGL). These liquids include ethane, propane, butanes, pentanes and natural gasoline. The NGL is stored on-site in pressurized tanks and shipped off-site via pipeline or tanker truck.

VOCs can be emitted from pumps, fittings, flanges and other connectors used in gas processing plants. Therefore, this equipment is subject to a stringent EPA NSPS regulation that requires the facility operator to implement a leak detection and repair program.¹⁰ A gas processing plant may also have natural gas-fired engines that drive refrigeration compressors, inlet gas compressors or outlet gas compressors. These engines are subject to the EPA NSPS and NESHAP regulations previously discussed.^{7,8}

Summary

Activity	Regulation	Goal	Control Method(s)
Drilling	Engine emissions standards	Limit emissions of NO _x , PM and SO ₂	Manufacturer's technology/diesel fuel sulfur standards
Hydraulic Fracturing	Engine emissions standards	Limit emissions of NO _x , PM and SO ₂	Manufacturer's technology/diesel fuel sulfur standards
Completion/Production Activities	State rules under state implementation plans (SIPs)	Limit emissions of VOC	Limited venting of flares and green completions
Gas Treatment	NESHAP for TEG Units	Limit emissions of HAP	Condensers, flares and VRUs
Gas Compression	NESHAP and NSPS for compressor engines	Limit emissions of NO _x , VOC and HAP	Low-emission engine technologies and catalysts on engine exhaust
Gas Processing	NSPS for fugitive emissions	Limit emissions of VOC	Leak Detection and Repair (LDAR) program

Information Sources

1. 40 CFR Part 89 – Control of Emissions from New and In-Use Nonroad Compression-Ignition Engines.
2. 40 CFR Part 80 – Highway and Nonroad Diesel Regulations.
3. 40 CFR Part 50 – National Primary and Secondary Ambient Air Quality Standards.
4. <http://www.epa.gov/gasstar/> (see Green Completions – PRO Fact Sheet No. 703).
5. <http://www.epa.gov/gasstar/> (see Lessons Learned – Installing Vapor Recovery Units on Crude Oil Storage Tanks).
6. 40 CFR Part 63, Subpart HH – National Emissions Standards for Hazardous Air Pollutants from Oil and Natural Gas Production Facilities.
7. 40 CFR Part 60, Subpart JJJJ – Standards of Performance for Stationary Spark Ignition Internal Combustion Engines.
8. 40 CFR Part 63, Subpart ZZZZ – National Emission Standards for Hazardous Air Pollutants for Reciprocating Internal Combustion Engines.
9. 30 TAC Chapter 117, Subchapter D - 117.2100(a).
10. 40 CFR Part 60, Subpart KKK – Standards of Performance for Equipment Leaks of VOC from Onshore Natural Gas Processing Plants.



About Chesapeake

Chesapeake Energy Corporation is the second-largest producer of natural gas, a Top 15 producer of oil and natural gas liquids and the most active driller of new wells in the U.S. Headquartered in Oklahoma City, the company's operations are focused on discovering and developing unconventional natural gas and oil fields onshore in the U.S. Chesapeake owns leading positions in the Barnett, Haynesville, Bossier and Marcellus natural gas shale plays and in the Granite Wash, Cleveland, Tonkawa, Mississippi Lime, Bone Spring, Avalon, Wolfcamp, Wolfberry, Eagle Ford, Niobrara, Three Forks/Bakken and Utica unconventional liquids plays. The company has also vertically integrated its operations and owns substantial midstream, compression, drilling, trucking, pressure pumping and other oilfield service assets. For more information on Chesapeake environment initiatives, visit the environment section of CHK.com, HydraulicFracturing.com, NaturalGasAirEmissions.com, NaturalGasWaterUsage.com, AskChesapeake.com or fracfocus.org.