

Mitigating and Regulating Methane Emissions

Efforts to decrease emissions from the oil and gas industry

Introduction

Methane is the main component of almost all natural gas, and gas delivered to end-users is purified to 95-98% methane.¹ There are three main sources of methane emissions from the oil and gas industry:

- When a well is being drilled, cleaned out, or hydraulically fractured. As the fluids involved in these operations flow back up the well to the surface they bring methane with them, which can escape into the atmosphere.
- Through leaky equipment in wells, processing plants, and pipelines.



Uncaptured natural gas being flared off in the Bakken oil field, converting the methane to carbon dioxide. Image credit: Wikimedia Commons user Joshua Doubek.²

- When operators burn off (“flare”) or vent small amounts of methane produced from oil wells. This commonly occurs when the gas cannot be sold due to low quality or lack of pipeline access. Flaring converts methane to carbon dioxide, but venting directly emits methane into the atmosphere.

There is a strong environmental incentive to reduce emissions of methane: it is a potent greenhouse gas that traps much more heat per molecule than carbon dioxide.³ Methane in natural gas also coexists with a number of other organic compounds that contribute to the formation of ozone, which is harmful to plants and animals, including humans.⁴ Some efforts to reduce these kinds of emissions are voluntary;⁵ others are legally required by government regulations. Some regulations are enacted at the federal (national) level by the Environmental Protection Agency (EPA),⁶ while others are enacted and enforced by individual states.⁷ The EPA also supports voluntary programs to assist both the energy and agricultural industries in reducing their methane emissions.

Methane-related regulations include the use of “green” (reduced-emission) completions for gas wells, reduction of gas flaring, and leak monitoring and repair.

Green Completions of Oil and Gas Wells

Well “completion” involves all of the processes needed to get a well ready to produce oil and/or gas, including hydraulic fracturing. During these processes, mud and water from drilling and hydraulic fracturing (if used) flow back up the well to the surface along with some water contained in the oil- or gas-bearing rocks. This stream of fluids often brings oil and gas with it, and the gas has historically been allowed to escape into the atmosphere or flared off (see below). “Green” completions use specialized equipment to capture these gases and fluids.⁸ Captured methane may then be used on-site or sold.

Since 2015, the EPA has required that green completions be used for all hydraulically fractured natural gas wells.⁹ Prior to this, Wyoming,

Colorado, and some cities in Texas had each implemented their own regulations requiring green completions, and some operators had voluntarily used green completions in other areas.⁹ As of 2018, the EPA regulations requiring green completions for oil wells are being considered for possible revisions.¹⁰

Reducing Natural Gas Flaring

In areas that produce mostly oil with small amounts of gas, operators often start moving the high-value oil to refineries before pipelines can be built to transport the less valuable natural gas. Instead, this gas is simply “flared,” i.e., burned in an open flame. This controlled burning prevents the buildup of flammable methane and converts methane to carbon dioxide – a less potent greenhouse gas. However, flaring wastes usable energy, increases the carbon footprint of the industry, and decreases the royalties that landowners – including private citizens and the government – could earn from the sale of this methane.

Flaring is typically most common in new areas of high oil production, and decreases as pipelines are built to transport the gas. For example, flaring was widely used in the rapidly growing Bakken area of North Dakota in the early-mid 2010s. From early 2014 to early 2016, flaring in North Dakota fell from 36% to 10% of produced gas as production fell (due to lower oil prices) and a local network of pipelines was constructed to collect the gas from individual wells.¹¹



Natural gas infrastructure includes a large number of valves and connectors, such as at this gas processing facility in Montgomery County, Texas. Components such as these may be sources of gas leaks. Image credit: Roy Luck, Flickr.¹²

The Bureau of Land Management (BLM) issued a rule in November 2016 that limited flaring on federal lands.¹³ In late 2017, parts of this rule were temporarily suspended or delayed until January 2019, pending review of the rule by BLM.

Leak Detection and Mitigation

In 2016, the EPA issued emissions standards aimed at reducing methane emissions from new sources or facilities by detecting leaks and repairing or replacing leaking equipment at oil and natural gas wells, processing plants, pipelines, gas compressors, and valves and connectors in these systems.¹⁴ As of 2018, the Administration, Congress, and the courts are involved in multiple ongoing actions to amend, advance, or delay the regulation.^{10,15}

Some states, such as California¹⁶ and Pennsylvania,¹⁷ require operators to perform periodic leak detection surveys of oil and gas facilities, followed by mandatory repair or replacement if leaks are found.

Voluntary Emissions Reduction Programs

The EPA’s voluntary Natural Gas STAR certification program, which includes over 150 partnerships with oil and gas production, transmission, and distribution companies, encourages and documents the use of emissions-reducing technologies.¹⁸

Because methane emissions are also a major issue in agriculture, EPA’s AgSTAR program promotes the use of biogas recovery systems to capture methane emissions from livestock waste to be used as fuel.¹⁹

References & More Resources

For a complete listing of references, see the “References” section of the full publication, *Petroleum and the Environment*, or visit the online version at: www.americangeosciences.org/critical-issues/petroleum-environment

Bradbury, J. et al. (2013). *Clearing the Air: Reducing Upstream Greenhouse Emissions from U.S. Natural Gas Systems*. Working Paper. Washington, DC: World Resources Institute. <http://www.wri.org/publication/clearing-air>