



# **METHANE MITIGATION ROADMAP**

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## INTRODUCTION

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NMOGA's operators have undertaken a proactive approach to both reduce methane and VOC emissions and capture as much natural gas as possible. To accomplish this, NMOGA's operators have turned to science, innovation, and collaboration to prevent waste, to greatly reduce methane and VOC emissions, and to improve air quality, all while creating jobs for New Mexicans. We are pushing forward, investing in technological advancements, and collaborating with regulatory agencies to achieve this goal.

NMOGA supports a practical, cost-effective methane and VOC mitigation strategy, and considers this as a win for all involved. This NMOGA methane document includes the New Mexico oil and gas industry's four highest reported sources: (1) equipment leaks, (2) storage vessels, (3) pneumatic devices, and (4) liquids unloading operations. We also provide regulatory suggestions and considerations that are based on sound science from peer-reviewed data and are effective in reducing methane and VOC emissions to improve air quality.

Upstream of the gas plant, which is production and gathering/boosting operations, methane and VOC are co-emitted. VOCs and methane are combined stream of gas until the gas stream reaches the gas plant, where most VOCs are separated from the natural gas, which is then primarily methane. Any control upstream of the gas plant that reduces VOC also controls methane.

## SUMMARY OF REGULATORY CONSIDERATIONS AND SUGGESTIONS

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Effective methane and VOC reduction regulations should be based on (1) pertinent regulatory applicability thresholds, (2) practical implementation of controls based upon broadly acceptable methods for establishing costs and emissions benefits, (3) good engineering practices, (4) applicable and credible science, and (5) reasonable boundaries for recordkeeping.

NMOGA supports regulatory flexibility to avoid a “one size fits all” regulatory scheme. For example, New Mexico’s two major oil and gas producing basins, the San Juan (Northwest) and Permian (Southeast), have profoundly different production characteristics. Wells in the San Juan primarily produce drier gas, which may result in the production of small amounts of condensate. Also, San Juan wells are generally both lower producers and older compared to horizontal wells in the Permian, which consequently results in lower emissions on a per facility basis. The Permian basin in Southeast New Mexico is primarily an oil producing basin, with associated gas production. In the Permian basin, wells tend to have higher initial production before entering into a prolonged period of declining production. The production profiles of each basin are so vastly different, which in turn dictates the types of operations and equipment used. These differences should be recognized when examining any potentially prescriptive standards.

With appropriate flexible regulatory language to reduce methane and VOC emissions, NMOGA supports for existing equipment: (1) annual leak detection and repair with exemptions for low producing wells and facilities that are not required to obtain a Notice of Intent, (2) storage vessel control requirements with appropriate thresholds, (3) phase-out of high-bleed pneumatic controllers unless required for safety function; and (4) onsite monitoring of manual liquids unloading operations. NMOGA requests that NMED recognize that many equipment sources are already subject to controls under federal NSPS OOOO and OOOOa regulations and an additional layer of state regulations will impose further requirements and costs without attendant emission reductions.

## NEW MEXICO SPECIFIC DATA FROM EPA GREENHOUSE GAS REPORTING RULE

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The Environmental Protection Agency (EPA) Greenhouse Gas Reporting Program (GHGRP) requires that operators submit estimates of their emissions annually using EPA prescribed methodology. Reporting is required if a facility's total GHG emissions exceed the reporting threshold of 25,000 mtCO<sub>2</sub>e per geographic basin. Because some facilities do not have GHG emissions that exceed the reporting threshold the dataset is not a comprehensive inventory. The EPA dataset does provide useful equipment comparison analysis and provides emission trends for the reported population. Nationally, reported oil and gas methane emissions declined by about 14% while oil and gas production increased more than 80% and 51% respectively from 1990 to 2017. These large methane reductions during an increase in oil and gas drilling activity are driven by a combination of voluntary/good operating practice implementation, and state and federal rule and permit actions that reduce methane emissions from the oil and gas sector.

Also, a recent study conducted by researchers at National Oceanic and Atmospheric Administration's Boulder, Colorado office in collaboration with the University of Colorado was published in Geophysical Research Letters. The study analyzed atmospheric methane (CH<sub>4</sub>) measurements from 20 North American sites that included both airplane and surface samples found in the NOAA Global Greenhouse Gas Reference Network (GGGRN) from 2006 to 2015. The study concludes that not only have there been no large increases in U.S. methane emissions over the last decade, but previous studies have significantly overestimated these emissions from U.S. oil and natural gas production, overestimating methane emissions volumes by as much as 10 times.

<sup>1</sup>For oil and gas production, a facility is basin-wide production equipment

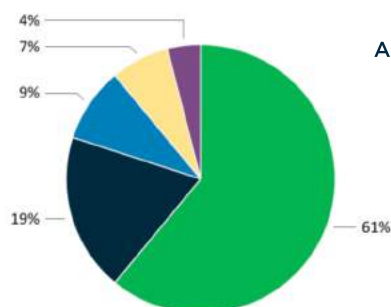
## NEW MEXICO SPECIFIC DATA FROM EPA GREENHOUSE GAS REPORTING RULE

The data represented below reflects an analysis using the EPA GHGRP reported data from New Mexico oil and gas operations. The data is reported by basin, not by state, and includes reported methane emissions from the Northwest New Mexico San Juan Basin and the Southeast New Mexico Permian Basin. Both basins cross state boundaries into other states (Colorado for the San Juan and Texas for the Permian) and GHGRP emissions reported for source types at the basin level without specific location information are allocated amongst the relevant states based on GHGRP reported well counts in each state.

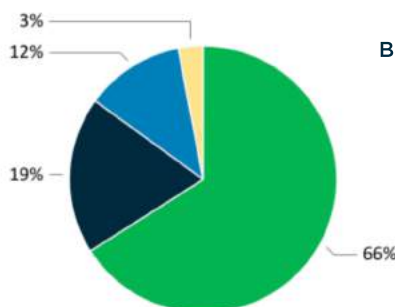
For source types with location (county and state) information, reported emissions are directly aggregated. In 2017, scaled-up GHGRP reported methane emissions in NM totaled 205,470 metric tonnes (MT's). In 2011, 50% of wells in the Permian basin were included in GHGRP reporting, and by 2017 coverage increased to 72%. In the San Juan Basin, over 85% of wells have been included in GHGRP reporting since 2011. For the production segment, we have scaled all emissions in each year up to the total well count reported by the New Mexico Oil Conservation Division (NMOCD). For the Gathering and Boosting segment, a) companies with facilities greater than 25,000 MT's are reported, and b) companies with facilities less than the 25,000 MT's (small source of methane emissions) are not reported. GHGRP reported emissions are shown.

● Pneumatics ● Unloading Equipment ● Liquids ● Tanks ● Other

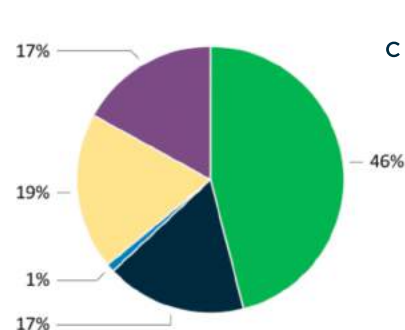
**2017 NM O&G METHANE EMISSION MT'S**



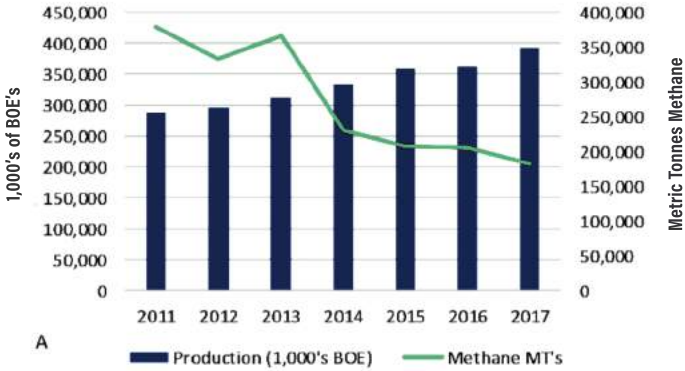
**2017 SAN JUAN NM O&G METHANE EMISSION MT'S**



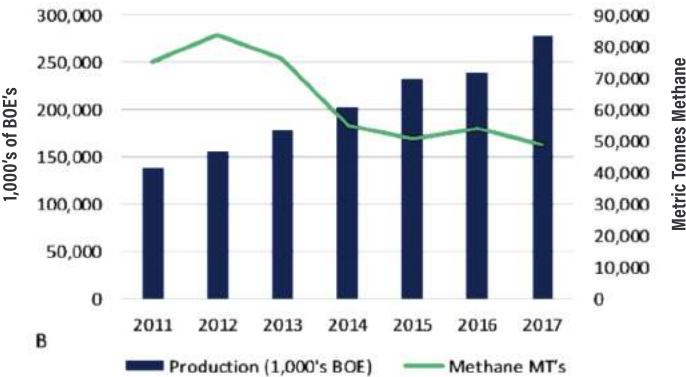
**2017 PERMIAN NM O&G METHANE EMISSION MT'S**



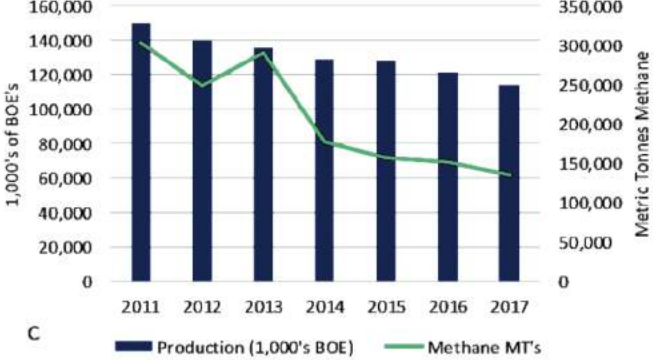
NEW MEXICO - OIL AND GAS PRODUCTION & METHANE EMISSIONS



PERMIAN BASIN NM - OIL AND GAS PRODUCTION & METHANE EMISSIONS



SAN JUAN BASIN NM - OIL AND GAS PRODUCTION & METHANE EMISSIONS



PANEL A:  
NEW MEXICO PRODUCTION AND METHANE EMISSIONS;

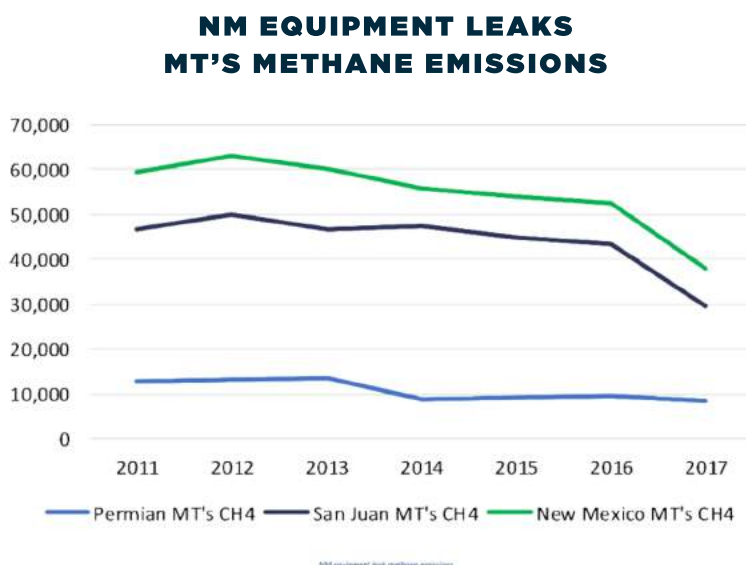
PANEL B:  
PERMIAN BASIN NM PRODUCTION AND METHANE EMISSIONS;

PANEL C:  
SJ BASIN PRODUCTION AND METHANE EMISSIONS

## THE FOUR MOST REPORTED SOURCES OF EMISSIONS

### 4.1. FUGITIVE EMISSIONS

TRENDS - EPA GHGRP



### Description

All production facilities contain numerous equipment components such as valves, flanges, threaded connections, tubing connections, open-ended lines (OELs), and pump seals which are manufactured and installed in ways intended to contain gases or liquids. Although these equipment components are designed to be gas tight, over time leaks can occur. The leaks (emissions) from these components are called fugitive emissions<sup>2</sup>. Fugitive emissions do not include equipment that is designed to vent or release emissions as part of normal operations. Fugitive emissions result from changes in pressure, temperature or mechanical stresses or when seals and gaskets are not fitted or deteriorate over time.

Sources of fugitive emissions are generally detected quickly without advanced detection tools. These events are usually detected by observable changes in operating parameters (i.e. Supervisory Control and Data Acquisition (SCADA) system detection, change in sales volume at the meter, compressor shut down), or by operators conducting routine inspections using sight, sound or smell.

<sup>2</sup>Where devices are designed to vent as part of normal operations, such as natural gas-driven pneumatic devices or uncontrolled storage vessels, the natural gas and associated VOC emissions are not considered a fugitive emission. These emissions are covered in other portions of this document.



## THE FOUR MOST REPORTED SOURCES OF EMISSIONS

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Leak detection and repair (LDAR) programs employ specialized detection equipment to detect fugitive emissions, which also sometimes include audio, visual, and olfactory observations, generally target sources of fugitive emissions. The most commonly used leak detection equipment is an optical gas imager, but companies also use handheld “sniffers” (portable detectors) and Tunable Diode Laser Absorption Spectroscopy devices. The detection technology space has received significant investment over the past several years, including the U.S. Department of Energy’s MONITOR program<sup>3</sup>. The results of this investment are just beginning deployment and may be widely available at commercial scale in the near term.

### Regulatory Considerations and Suggestions

- NMOGA supports the development of a cost-effective LDAR program for existing facilities, as long as these avoid duplication with existing federal programs, such as the LDAR provisions of NSPS OOOOa and NSPS KKK.
- A recent review of NSPS OOOOa leak survey data indicates that annual inspection frequency is appropriate for non-marginal well sites or facilities<sup>4</sup>. Data from various federal and state and inspection programs, including Colorado, demonstrates that the initial component leak rate from initial inspection surveys, show a significantly lower number of leaks than previously assumed. For example, an API analysis of initial NSPS OOOOa inspections showed that only 0.4% of components are found to be leaking during the initial inspection. West Slope Colorado data showed a 0.74% component leak rate for sites with emissions less than 6 tons per year VOC.
- Additionally, the number of leaks found in inspections at subject facilities in Colorado show a 52% decrease in the number of leaks from 2015 to 2017, while the number of facilities inspected increased by 9%.

## THE FOUR MOST REPORTED SOURCES OF EMISSIONS

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- Marginal wells (< 15 barrels of oil equivalent per day) should be excluded from the LDAR program. Marginal wells, by their nature, are lower producing and generally requires less equipment with fewer components. In fact, data has indicated that leak detection is most effective for newer systems to ensure that all componentry and equipment is tightened from the outset and that the frequency of detection lowers over time. These factors mean that the cost of each marginal well LDAR survey often outweighs the benefits of the potential emission reductions and can threaten their financial viability. In the oil-and-gas control technique guidelines, EPA expressly recognized that fugitive emissions at low-production sites are inherently low and thus included an exemption from the LDAR program for well sites with an average production of less than 15 barrels of oil equivalent per day. Unless and until additional, comprehensive and conclusive data has been collected to suggest that marginal wells warrant inclusion in an LDAR program, these wells should be excluded. Leak data on marginal wells is very limited and warrants further study through objective, transparent, repeatable, and reliable emissions measurements. The sample size of the current data set is too small to provide conclusive results. Proper inspection methods and associate frequency must be informed by well-established data that can correlate production and emissions. Other factors that must be weighed are type and quantity of equipment, frequency of episodic emission events, equipment age/condition, and absolute contribution to total emissions. The Department of Energy is co-funding such a study titled “Quantification of Methane Emissions from Marginal (Small Producing) Oil and Gas Wells” being conducted by GSI Environmental Inc.
- Wellhead only locations should not be included in the LDAR program due to very limited equipment on location, consistent with NSPS OOOOa. Facilities that do not require a Notice of Intent similarly have limited equipment and should be exempt from a LDAR program. Uncontrolled equipment, such as low emitting tanks, would also not benefit from an LDAR program as emissions will fall below the allowable permit limits, with or without an inspection program.

## THE FOUR MOST REPORTED SOURCES OF EMISSIONS

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- Maximum flexibility should be afforded to owners or operators to utilize new technologies for identifying leaks. Industry has partnered with academia and NGOs to explore innovative technologies to cost-effectively and accurately locate methane emissions associated with oil and gas locations. Low-cost sensing systems are needed to reduce methane leaks, minimize safety hazards and promote more efficient use of our domestic resources. Various field tests are being deployed to demonstrate the performance capabilities of such sensing technologies and accelerate the commercialization of such. It is imperative that regulatory agencies unlock the benefits of these emerging technologies by providing a flexible regulatory construct. New Mexico has a unique opportunity to set the stage to encourage adoption of innovative technologies.

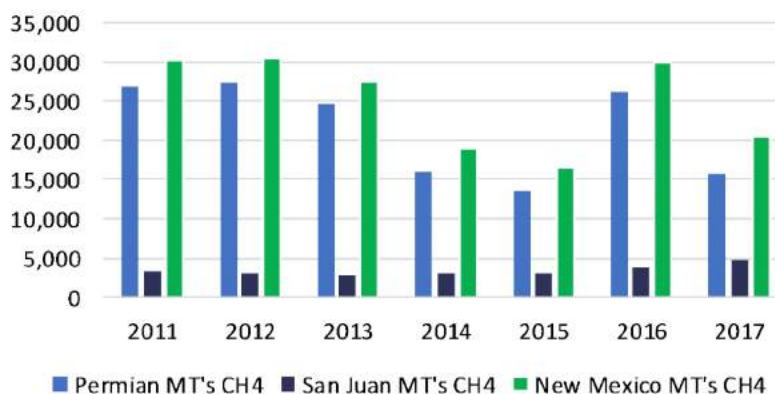
- Emerging detection technologies may lead to variable work practices. For example, sensors flown on aircraft may have a higher leak threshold but will cover a wider geographical area and therefore can be more cost-effectively conducted at a greater frequency. Enabling new technologies may also require flexibility in work practices, as long as overall emissions reductions are equivalent.

## THE FOUR MOST REPORTED SOURCES OF EMISSIONS

### 4.2. STORAGE TANKS

TRENDS - EPA GHGRP

NM METHANE METRIC TONNES FROM TANKS



### Description

Storage vessels in the production sector of the oil and natural gas industry are used to hold liquids including crude oil, condensates, and produced water. Storage vessels can be installed as a single unit or in a grouping of similar or identical vessels, commonly referred to as a tank battery. Before being routed to a storage vessel, production liquids are passed through the separation equipment, where most of the gas entrained in the liquids is separated and routed to a sales line or control device. The liquids are then directed to a storage vessel where they are temporarily stored before being transported off-site. Although the majority of gases are removed from the liquids during the separation process, small concentrations of gas remain and will “flash” off when the liquids reach storage vessels operating at atmospheric pressure. Depending on a site’s configuration, vapors that accumulate in the space above the liquid level in storage vessels may be routed to a gas sales line via a process unit such as a vapor recovery unit, if gas volumes are sufficient, or control device such as a vapor combustion device or flare.



## THE FOUR MOST REPORTED SOURCES OF EMISSIONS

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### Regulatory Considerations and Suggestions

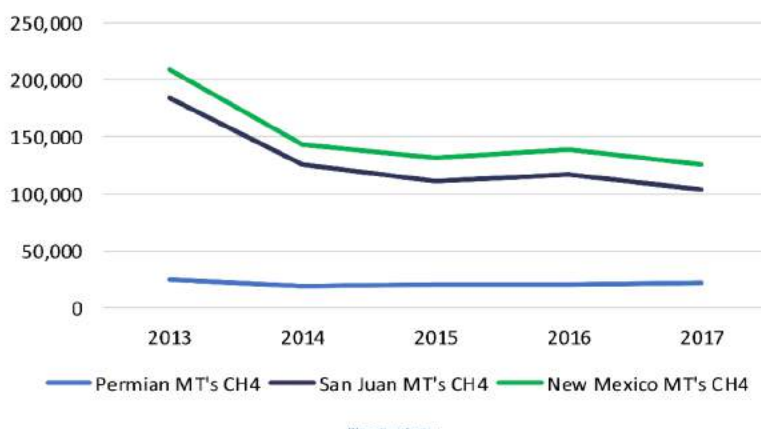
- NMOGA supports storage tank equipment control requirements for existing facilities not already subject to NSPS OOOO/OOOOa with appropriate thresholds. American Petroleum Institute's December 4, 2015 comments to EPA on the draft Control Techniques Guidelines suggests that a 15 tons per year VOC threshold is appropriate as existing source retrofits are more costly than controls on a new source. The throughput impacts the ability of the control equipment to function effectively. As noted in EPA's OOOO/OOOOa, requiring controls for new storage tanks below a certain VOC threshold may not be effective. For existing storage tanks, the control threshold will be even higher due to the additional cost to retrofit the equipment.
- It should be noted that many existing storage vessels are currently subject to controls under NSPS OOOO/OOOOa. In New Mexico, the enforceable state program (GCP Oil and Gas) allows operators to account for emissions reductions processes when calculating potential to emit to determine NSPS OOOO/OOOOa applicability for new storage vessels. EPA expressly allows for operators to account for enforceable limitations under state programs to prevent operators from being subject to duplicative requirements under state and federal law. To avoid duplication, storage vessels should only be required to comply with either NSPS OOOO/OOOOa or the state program, not both.
- The economics and technical feasibility of replacing or retrofitting existing storage vessels and associated equipment warrants a layered analysis, incorporating costs, timeframes, types of production, geographic location, and other considerations. Any storage vessels not currently subject to OOOO/OOOOa which are replaced due to new state regulation or due to reaching end of usable life will be subject to OOOO/OOOOa. NMOGA is currently exploring these considerations.
- Many existing storage vessels at older facilities were not designed for utilizing control devices as it can result in inherent safety risks by compromising tank integrity and causing tank over pressurization. Remaining useful life should be considered in any regulation.

## THE FOUR MOST REPORTED SOURCES OF EMISSIONS

### 4.3. PNEUMATIC CONTROLLERS

TRENDS - EPA GHGRP

#### NM PNEUMATIC CONTROLLER METHANE MT'S EMISSIONS



#### Description

The oil and natural gas industry uses a variety of process control devices to operate valves that regulate safety shut-down, position, fluid level, pressure, temperature and flow rate. Natural gas powered pneumatic controllers are process control devices used throughout the oil and natural gas industry as part of the instrumentation to control the position of valves and may be actuated using pressurized natural gas (natural gas-driven)<sup>5</sup>. Natural gas driven pneumatic devices are a direct source of methane emissions.

Natural gas driven pneumatic controllers are classified by the EPA in three categories:

- Continuous High Bleed: These controllers vent continuously at a rate of over 6 scf/hour per manufacturer specifications.
- Continuous Low Bleed: These controllers vent continuously at a rate of less than 6 scf/hour per manufacturer specifications.
- Intermittent Vent: These controllers vent only when actuating. Depending on the type of service or operation the controller is in, it can actuate only a few times a year, or multiple times per hour.

<sup>5</sup> [https://www.spe.org/media/filer\\_public/35/05/3505095e-314c-4acb-94b5-893415e00df1/19\\_pr172505.pdf](https://www.spe.org/media/filer_public/35/05/3505095e-314c-4acb-94b5-893415e00df1/19_pr172505.pdf)

## THE FOUR MOST REPORTED SOURCES OF EMISSIONS

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### Regulatory Considerations and Suggestions

- NMOGA supports phasing out of continuous, gas powered, high bleed pneumatic controllers as there are commercially proven, cost-effective alternatives available. Sufficient time (e.g., 3 years) for manufacturers of alternatives to stock enough supply is necessary.
- For some replacement or retrofit activities, it is necessary to conduct such work during a turnaround.
- It is not practical to eliminate use of all natural gas driven pneumatic controllers. Some pneumatic controllers are critical for operational integrity and safety, and must be able to operate reliably. In areas without access to electricity, or on small sites where air compression is not economically feasible, natural gas driven controllers are needed. Also, in areas where electricity supply may be regularly interrupted due to third party electrical reliability issues, natural gas driven pneumatics provide a critical role in allowing for safe and consistent operations.

## THE FOUR MOST REPORTED SOURCES OF EMISSIONS

### 4.4. WELL MAINTENANCE AND WELL LIQUIDS UNLOADING

EQUIPMENT SPECIFIC TRENDS - EPA GHGRP

#### 2017 NEW MEXICO LU VENTING MT'S METHANE EMISSIONS

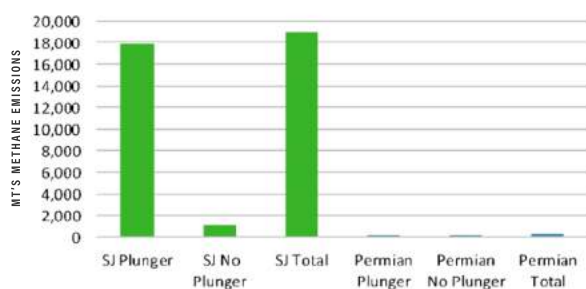
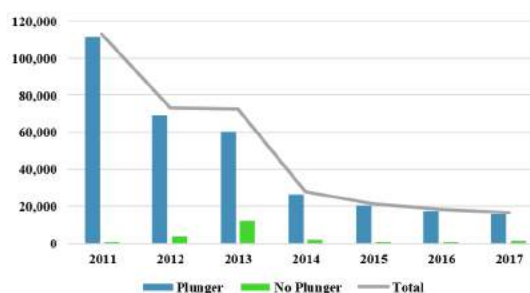


Figure 10: 2017 MT's methane emissions (from venting for liquid unloading)

#### GHGRP NM - MT'S CH4 LU VENTING



### Description

Managing wellbore liquid build-up in wells is fundamental to maintaining production, avoiding early abandonment of wells and maximizing resource recovery. Wells and reservoirs follow a continuum of flow regimes in their economic life as the reservoir depletes, production goes down, wellbore (tubing) velocity decreases, and liquid loading begins to occur in the wellbore. Liquid loading begins when the velocity up the production string is not sufficient to drag liquids up the wellbore. While pressure is a factor, it is generally velocity, not pressure, which causes liquids to accumulate in the wellbore (i.e., "to load"). Gas well unloading is a complex field of engineering where a large number of different technologies, tools and practices are matched to individual well characteristics at each stage of its lifecycle to most efficiently manage liquids and maintain economic production. No single technique will be adequate or appropriate across the full lifecycle of a well.



## THE FOUR MOST REPORTED SOURCES OF EMISSIONS

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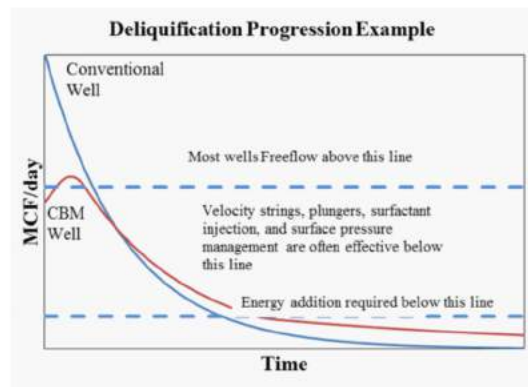
As a well moves through its lifecycle, the appropriate approach to managing liquids changes as shown in Figure 1 below. New wells typically have production rates and flowing velocity high enough that liquids loading is not an issue. As the portion of the reservoir accessed by a well depletes, the production rate and consequent velocity declines and eventually reaches a point where liquid loading is an issue. The time this takes to occur is dependent on the reservoir characteristics and varies from well to well. At the onset of liquid unloading, techniques that rely on the reservoir energy are typically used. These include:

- **Intermitting:** Shutting in a well for a period of time to allow the reservoir to “refill” the pressure and the volume “void” in the near-wellbore reservoir. When the well is restarted the production rate and velocity are higher and the well can “unload” liquids through the normal production route to sales;
- **Velocity strings:** Installing a smaller diameter tubing string in the well that increases the flow velocity at a given production rate sufficiently to drag liquids up the wellbore and prevent liquid loading. Due to the trade-off between higher flowing friction in smaller diameter tubing and increased velocity the practical lower diameter limit is approximately 1 inch;
- **Surfactants and foaming agents:** Introducing surfactants and foaming agents to the bottom of a well (various techniques are used) creates foam with lower specific gravity which enables liquids to be carried up the wellbore at lower velocities;
- **Artificial lift:** Installing a plunger lift system that changes the dynamic for removing liquids from velocity to differential pressure between the bottom-hole and the surface/gas collection line; and
- **Additional compression:** Installing wellhead compression that lowers the surface back-pressure on a well, increases production rate and flowing velocity, and increases the differential pressure between the reservoir and the collection/sales line.

## THE FOUR MOST REPORTED SOURCES OF EMISSIONS

These techniques can be used individually or in combination to manage wellbore liquids and maintain production.

**FIGURE 1: DELIQUIFICATION PROGRESSION EXAMPLE**



Eventually a well will reach a point where the reservoir energy is insufficient to remove the liquids from the well and adding energy to the well is necessary to continue production. Common approaches are to install a pump in the well or install a gas lift system. Installation of a system to add energy to a well is an economic decision based on whether the continuing production warrants the costs of installing and operating a pump or gas lift system. Reservoir engineers and operators must have the flexibility to employ the appropriate tools at the appropriate times to manage wellbore liquids.

## THE FOUR MOST REPORTED SOURCES OF EMISSIONS

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### Regulatory Considerations and Suggestions

EPA concluded for NSPS OOOOa that regulating venting and emissions associated with managing wellbore liquids is not feasible due to the complexity of managing well production. Adoption of Best Management Practices allows operators to determine the most efficient way to reduce liquids unloading emissions. Practices such as monitoring manual liquids unloading can result in emissions reductions. Deliquification/liquid-unloading and venting are not synonymous terms. Liquids can and are routinely removed from gas wells without venting. About 85% of the gas wells in the U.S. have low enough production rates to have liquid loading issues, and only about 13% have liquids unloading venting to assist liquid removal in 2012 (gross up of GHGRP data).

The key to minimizing venting while maintaining liquid removal is understanding and using the reservoir energy dynamics - in particular, build-up of pressure. Venting wells “waste” reservoir energy, which can be used to manage liquids and maintain production.

Many technologies are not suitable for certain wells or in certain areas. Gas to liquid ratio of each well affects feasibility. Appropriate technologies and economic feasibility will vary during the lifecycle of a well, particularly as production declines. Here are some examples of considerations for various options:

- Artificial Lift: Use of any specific artificial lift technology for moving liquids off well where reservoir pressure is not sufficient to move it naturally is dependent on well type, reservoir conditions and cost of technology.
- Plunger lifts: Difficult in areas that produce significant amounts of water
- Pump jacks and compressors: Greater surface disturbance and increased noise
- Rod pump/progressing cavity pumps: Not effective on deep and deviated wells, increased surface disturbance and greater energy requirements
- Electric operated equipment: May require generators creating additional emissions

## SUMMARY OF FEDERAL AIR QUALITY REGULATIONS THAT APPLY TO THE OIL AND GAS SECTOR IN NEW MEXICO \*

40 CFR part and subpart	Title of subpart	Potentially affected sources in the oil and natural gas production and natural gas processing segments of the oil and natural gas sector	Location
40 CFR part 63, subpart DDDDD	National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters.	Process heaters	<a href="http://www.ecfr.gov/cgi-bin/text-idx?SID=9f31077f895e9cb417f5386519941a47&amp;mc=true&amp;node=sp40.14.63.ddddd&amp;rgn=div6">http://www.ecfr.gov/cgi-bin/text-idx?SID=9f31077f895e9cb417f5386519941a47&amp;mc=true&amp;node=sp40.14.63.ddddd&amp;rgn=div6</a>
40 CFR part 63, subpart ZZZZ <sup>b</sup>	Subpart ZZZZ—National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines	Reciprocating Internal Combustion Engines.	<a href="http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr;rgn=div6;view=text;node=%3A14.0.11.1.1;idno=40;sid=e94dcfde4a04b27290c445a56e635e58;cc=ecfr">http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr;rgn=div6;view=text;node=%3A14.0.11.1.1;idno=40;sid=e94dcfde4a04b27290c445a56e635e58;cc=ecfr</a>
40 CFR part 60, subpart IIII	Standards of Performance for Stationary Compression Ignition Internal Combustion Engines.	Compression Ignition Internal Combustion Engines.	<a href="http://www.ecfr.gov/cgi-bin/text-idx?SID=9f31077f895e9cb417f5386519941a47&amp;mc=true&amp;node=sp40.7.60.iii&amp;rgn=div6">http://www.ecfr.gov/cgi-bin/text-idx?SID=9f31077f895e9cb417f5386519941a47&amp;mc=true&amp;node=sp40.7.60.iii&amp;rgn=div6</a>
40 CFR part 60, subpart JJJJ	Standards of Performance for Stationary Spark Ignition Internal Combustion Engines.	Spark Ignition Internal Combustion Engines.	<a href="http://www.ecfr.gov/cgi-bin/text-idx?SID=9f31077f895e9cb417f5386519941a47&amp;mc=true&amp;node=sp40.7.60.iiij&amp;rgn=div6">http://www.ecfr.gov/cgi-bin/text-idx?SID=9f31077f895e9cb417f5386519941a47&amp;mc=true&amp;node=sp40.7.60.iiij&amp;rgn=div6</a>
40 CFR part 60, subpart Kb	Standards of Performance for Volatile Organic Liquid Storage Vessels (Including Petroleum Liquid Storage Vessels) for Which Construction, Reconstruction, or Modification Commenced After July 23, 1984.	Fuel Storage Tanks	<a href="http://www.ecfr.gov/cgi-bin/text-idx?SID=9f31077f895e9cb417f5386519941a47&amp;mc=true&amp;node=sp40.7.60.k.0b&amp;rgn=div6">http://www.ecfr.gov/cgi-bin/text-idx?SID=9f31077f895e9cb417f5386519941a47&amp;mc=true&amp;node=sp40.7.60.k.0b&amp;rgn=div6</a>
40 CFR part 60, subpart OOOO and OOOOa (final).	Standards of Performance for Crude Oil and Natural Gas Facilities for which Construction, Modification, or Reconstruction Commenced after September 18, 2015.	Storage Vessels, Pneumatic Controllers, Compressors (Reciprocating and Centrifugal), Hydraulically Fractured Oil and Natural Gas Well Completions, Pneumatic Pumps and Fugitive Emissions from Well Sites and Compressor Stations.	<a href="http://www.epa.gov/airquality/oilandgas/actions.html">http://www.epa.gov/airquality/oilandgas/actions.html</a>
40 CFR part 63, subpart HH	National Emission Standards for Hazardous Air Pollutants from Oil and Natural Gas Production Facilities.	Glycol Dehydrators	<a href="http://www.ecfr.gov/cgi-bin/text-idx?SID=9f31077f895e9cb417f5386519941a47&amp;mc=true&amp;node=sp40.11.63.hh&amp;rgn=div6">http://www.ecfr.gov/cgi-bin/text-idx?SID=9f31077f895e9cb417f5386519941a47&amp;mc=true&amp;node=sp40.11.63.hh&amp;rgn=div6</a>
40 CFR part 60, subpart KKKK <sup>7</sup> ...	Standards of Performance for New Stationary Combustion Turbines.	Combustion Turbines	<a href="http://www.ecfr.gov/cgi-bin/text-idx?SID=4090b6cf5eea5cb67940a80906ff09a2&amp;mc=true&amp;node=sp40.7.60.kkkk&amp;rgn=div6">http://www.ecfr.gov/cgi-bin/text-idx?SID=4090b6cf5eea5cb67940a80906ff09a2&amp;mc=true&amp;node=sp40.7.60.kkkk&amp;rgn=div6</a>

\* THIS LIST DOES NOT INCLUDE PERMITTING REQUIREMENTS.



## APPENDIX: NARRATIVE OF EPA OIL AND GAS REGULATIONS HISTORY

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In 1979, the EPA listed crude oil and natural gas production on its priority list of source categories for promulgation of NSPS (44 FR 49222, August 21, 1979). Since the 1979 listing, the EPA has promulgated performance standards to regulate VOC emissions from production, processing, transmission, and storage as well as sulfur dioxide (SO<sub>2</sub>) emissions from natural gas processing emission sources and, more recently, greenhouse gases (GHG). On June 24, 1985 (50 FR 26122), the EPA promulgated an NSPS for natural gas processing plants that addressed VOC emissions from leaking components (40 CFR part 60, subpart KKK). On October 1, 1985 (50 FR 40158), a second NSPS was promulgated for natural gas processing plants that regulated SO<sub>2</sub> emissions (40 CFR part 60, subpart LLL). On August 16, 2012 (77 FR 49490) (2012 NSPS), the EPA finalized its review of NSPS standards for the listed oil and natural gas source category and revised the NSPS for VOC from leaking components at natural gas processing plants, and the NSPS for SO<sub>2</sub> emissions from natural gas processing plants. At that time, the EPA also established standards for certain oil and natural gas emission sources not covered by the existing standards. In addition to the emission sources that were covered previously, the EPA established new standards to regulate VOC emissions from hydraulically fractured gas wells, centrifugal compressors, reciprocating compressors, pneumatic controllers, and storage vessels.

In 2016 (81 FR 35824, June 3, 2016), the EPA finalized new standards, NSPS OOOO, to regulate both GHG and VOC emissions across the oil and natural gas source category. In NSPS OOOOa, the EPA finalized: (1) GHG standards for the emission sources that were regulated only for VOC under NSPS OOOO (i.e., hydraulically fractured gas well completions, centrifugal compressors, reciprocating compressors, pneumatic controllers and equipment leaks at natural gas processing plants); and (2) GHG standards (in the form of limitations on methane emissions) and VOC standards for several emission sources not previously covered by the prior NSPS OOOO (i.e., hydraulically fractured oil well completions, pneumatic pumps, and fugitive emissions from well sites and compressor stations).

Finally, although not regulated under the oil and natural gas NSPS (OOOO and OOOOa), stationary reciprocating internal combustion engines and combustion turbines used in the oil and natural gas industry are covered under separate NSPS specific to engines and turbines (40 CFR part 60, subparts IIII, JJJJ, GG, KKKK).



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