



U.S. ENVIRONMENTAL PROTECTION AGENCY

OFFICE OF INSPECTOR GENERAL

Improvements Needed in EPA Efforts to Address Methane Emissions From Natural Gas Distribution Pipelines

Report No. 14-P-0324

July 25, 2014



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Abbreviations

CAA	Clean Air Act
CO ₂ e	Carbon dioxide equivalent
EDF	Environmental Defense Fund
EF	Emission factor
EPA	U.S. Environmental Protection Agency
GHG	Greenhouse gas
GHGRP	Greenhouse Gas Reporting Program
GRI	Gas Research Institute
GTI	Gas Technology Institute
LDC	Local distribution company
MMT	Million metric tons
NESHAP	National Emission Standards for Hazardous Air Pollutants
NSPS	New Source Performance Standards
OAR	Office of Air and Radiation
OIG	Office of Inspector General
PHMSA	Pipeline and Hazardous Materials Safety Administration
PSD	Prevention of Significant Deterioration
PUC	Public utility commission
SCF	Standard cubic feet
TPY	Tons per year

Cover photo: Damaged natural gas distribution pipeline. (U.S. Department of Transportation photo)

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At a Glance

Why We Did This Review

We conducted this evaluation to determine what actions the U.S. Environmental Protection Agency (EPA) has taken to reduce methane emissions from leaking pipelines in the natural gas distribution sector.

Methane is a potent greenhouse gas with a global warming potential 25 times that of carbon dioxide. In June 2013, President Obama issued the Climate Action Plan, which states that “curbing emissions of methane is critical to our overall effort to address global climate change.” In 2012, the EPA reported that methane leaks from pipelines in the natural gas distribution sector accounted for more than 13 million metric tons of carbon dioxide equivalent emissions. These leaks are comprised of natural gas product, which is almost 100 percent methane, and account for more than 10 percent of total methane emissions from natural gas systems.

This report addresses the following EPA goal or cross-agency strategy:

- *Addressing climate change and improving air quality.*

For further information, contact our public affairs office at (202) 566-2391.

The full report is at:
www.epa.gov/oig/reports/2014/20140725-14-P-0324.pdf

Improvements Needed in EPA Efforts to Address Methane Emissions From Natural Gas Distribution Pipelines

What We Found

The EPA has placed little focus and attention on reducing methane emissions from pipelines in the natural gas distribution sector. In 2012, the EPA stated its intent to continue to evaluate the appropriateness of regulating methane.

The 2013 Climate Action Plan calls for the EPA, in conjunction with other federal agencies, to develop a comprehensive

interagency strategy to address methane emissions. The EPA does not currently regulate methane emissions from the distribution sector and has not partnered with the Pipeline and Hazardous Materials Safety Administration, which regulates pipeline safety, to control methane leaks. The EPA has a voluntary program to address methane leaks—Natural Gas STAR—but its efforts through this program have resulted in limited reductions of methane emissions from distribution pipelines. This is due largely to financial and policy barriers, including disincentives for distribution companies to repair nonhazardous leaks.

The agency needs to address additional issues to better assess progress from the voluntary program and determine if future regulations are warranted. The EPA needs to set goals and track its progress in reducing emissions from distribution pipelines through its voluntary program. Also, the EPA needs to evaluate data from ongoing external studies to determine their usefulness for validating or updating its distribution pipeline emission factors. The emission factors that the EPA uses are based on a 1996 study, which has a high level of uncertainty. Two non-EPA groups are conducting studies that may be useful to the EPA. However, the EPA’s involvement in the design or protocols of these studies has been limited.

Recommendations and Planned Corrective Actions

We recommend that the EPA (1) work with the Pipeline and Hazardous Materials Safety Administration to address methane leaks from a combined environmental and safety standpoint, (2) develop a strategy to address the financial and policy barriers that hinder reductions from the distribution sector, (3) establish performance goals, (4) track distribution sector emissions and use that data to help determine if future regulation would be appropriate, and (5) assess whether data from ongoing studies should be used to update distribution sector emission factors. The agency agreed with recommendations 1 and 2 and provided corrective action plans that meet the intent of the recommendations. The agency partially agreed with recommendations 3, 4 and 5 and these three recommendations are considered unresolved.

Methane emissions impact climate change through leaks in natural gas distribution pipelines, and also have economic impacts. We estimate that more than \$192 million in natural gas was lost in 2011 due to such leaks, a cost that is borne by consumers.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

THE INSPECTOR GENERAL

July 25, 2014

MEMORANDUM

SUBJECT: Improvements Needed in EPA Efforts to Address Methane Emissions From
Natural Gas Distribution Pipelines
Report No. 14-P-0324

FROM: Arthur A. Elkins Jr.

A handwritten signature in black ink, appearing to read "Arthur A. Elkins Jr.", is written over the printed name.

TO: Janet McCabe, Acting Assistant Administrator
Office of Air and Radiation

This is our report on the subject evaluation conducted by the Office of Inspector General (OIG) of the U.S. Environmental Protection Agency (EPA). This report contains findings that describe the problems the OIG has identified and corrective actions the OIG recommends. This report represents the opinion of the OIG and does not necessarily represent the final EPA position. Final determinations on matters in this report will be made by EPA managers in accordance with established audit resolution procedures.

The EPA offices having primary responsibility over the issues evaluated in this report are the Office of Air and Radiation's Office of Atmospheric Programs and Office of Air Quality Planning and Standards.

Action Required

Recommendations 1 and 2 are resolved; therefore no further response is needed for these recommendations. In accordance with EPA Manual 2750, for recommendations 3, 4 and 5, for which the agency only partially concurred, you are required to provide a written response to this report within 60 calendar days. You should include planned corrective actions and completion dates for these unresolved recommendations. Your complete response will be posted on the OIG's public website, along with our memorandum commenting on your response. Your response should be provided as an Adobe PDF file that complies with the accessibility requirements of Section 508 of the Rehabilitation Act of 1973, as amended. The final response should not contain data that you do not want to be released to the public; if your response contains such data, you should identify the data for redaction or removal along with corresponding justification.

We will post this report to our website at <http://www.epa.gov/oig>.

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Chapter 1

Introduction

Purpose

We conducted this evaluation to determine what actions the U.S. Environmental Protection Agency (EPA) has taken to reduce methane emissions from leaking pipelines in the natural gas distribution sector.

Background

Methane is a potent greenhouse gas (GHG). It has a global warming potential 25 times that of carbon dioxide. In addition to contributing to global climate change, methane emissions also worsen ground-level ozone problems and can kill trees and other vegetation. Emissions from leaks in natural gas distribution pipelines are comprised almost entirely of methane.

In June 2013, President Obama issued the Climate Action Plan, a broad-based plan to cut GHG pollution that causes climate change and affects public health. Among other things, the Climate Action Plan emphasizes that:

Curbing emissions of methane is critical to our overall effort to address global climate change. Methane currently accounts for roughly 9 percent of domestic greenhouse gas emissions and has a global warming potential that is more than 20 times¹ greater than carbon dioxide.

The Climate Action Plan calls for the EPA, in conjunction with several other agencies, to develop a comprehensive interagency methane strategy. This strategy (hereafter referred to as the 2014 interagency methane strategy) was issued in March 2014.² The strategy focuses on cutting methane emissions primarily from landfills, coal mines, agriculture, and the oil and natural gas industry. It calls for the EPA to:

- Develop a series of white papers on significant sources of methane emissions in the oil and natural gas industry, and solicit input from independent experts.
- Based on information from the white papers, determine what, if any, regulatory authorities the agency will apply to selected emission sources in the oil and natural gas industry.

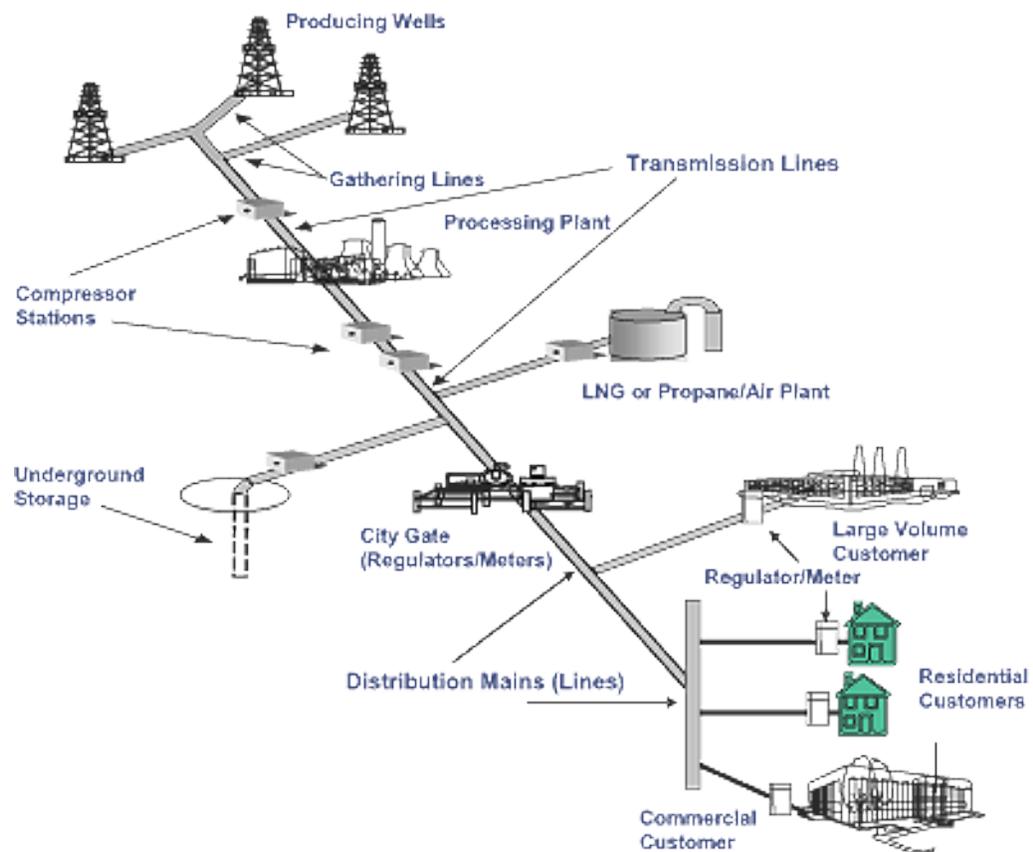
¹ In November 2013, the EPA amended its global warming potential for methane from 21 to 25 times that of carbon dioxide. The EPA made this change to align with the global warming potential for methane that was included in the Intergovernmental Panel on Climate Change's Fourth Assessment Report, which was issued in 2007.

² Climate Action Plan: Strategy to Reduce Methane Emissions, March 2014.

- Bolster its Natural Gas STAR program—a voluntary program to reduce methane emissions from the natural gas industry—by eliciting more robust industry commitments and enhancing transparency and accountability.
- Continue to enhance its inventory of GHG emissions, particularly for the natural gas industry.

Our evaluation focused on methane emissions from pipelines in the distribution sector of the natural gas industry. This includes distribution mains³ and service lines that transmit natural gas from the city gate⁴ to the end customer. Figure 1 shows how natural gas moves from production wells through transmission lines to the city gate and, ultimately, to residential and commercial customers. By the time natural gas reaches the distribution sector, almost all pollutants and impurities have been removed. At this point it is almost 100-percent methane.

Figure 1: Natural gas industry, from production through distribution



Source: The EPA.

^a Service lines are the lines from the distribution mains to the residential, commercial and industrial customers.

³ A *main* is a major pipeline conveying gas to smaller pipes, known as *service lines* or *services*, for distribution to residential, commercial and industrial consumers.

⁴ A *city gate* is the delivery point where the natural gas is transferred from a transmission pipeline to the local gas utility (called the local distribution company).

Methane Emissions From Distribution Pipelines

In 2012, the EPA reported that the total methane emissions from natural gas systems were 129.9 million metric tons (MMT) of carbon dioxide equivalent (CO₂e) emissions. Of this, more than 13 MMT CO₂e were attributed to emissions from distribution pipelines. This represents more than 10 percent of total methane emissions from natural gas systems.

Emissions from distribution pipelines occur due to leaks. Leaks are most likely to occur from older pipelines made of cast iron and unprotected steel. These leaks are caused by disturbances resulting from earth movement, the breakdown of joints, and corrosion of unprotected steel pipelines; and from the natural process of “graphitization” of iron pipelines. Graphitization is the process of iron degrading over time to softer elements. This process makes iron pipelines more prone to cracking. Leaks are much less likely to occur from plastic and protected steel pipelines.

In 2012, there were more than 1.2 million miles of distribution mains in the United States. Of this, more than 32,000 miles of mains were cast iron or wrought iron, and more than 61,000 miles were unprotected steel.

The amount of cast and wrought iron, and unprotected steel, pipeline varies substantially by state. For example, in 2012, New Jersey had at least 5,000 miles of cast and wrought iron mains while 16 other states had none. Table 1 shows the miles of cast and wrought iron pipelines (specifically, distribution mains) in the 10 states with the highest levels of these pipelines. These 10 states accounted for about 82 percent of the cast and wrought iron mains in 2012.

Table 1: Ten states with highest miles of cast and wrought iron natural gas distribution mains, 2012

State	Miles of distribution mains	Percentage of distribution mains in state	Miles of distribution mains as a percentage of nationwide total
New Jersey	5,044	15%	15.6%
New York	4,417	9%	13.6%
Massachusetts	3,792	18%	11.7%
Pennsylvania	3,221	7%	9.9%
Michigan	3,101	5%	9.6%
Illinois	1,744	3%	5.4%
Connecticut	1,467	19%	4.5%
Maryland	1,399	10%	4.3%
Alabama	1,383	5%	4.3%
Missouri	1,113	4%	3.4%
Total	26,681		82.3%

Source: Office of Inspector General (OIG) analysis of Pipeline and Hazardous Materials Safety Administration (PHMSA) data.

In 2012, the miles of distribution mains made of unprotected steel ranged from a high of 9,044 miles in Ohio to zero miles in five states. Table 2 shows the miles of unprotected steel pipelines (specifically, distribution mains) in the 10 states with highest levels of unprotected steel pipelines. As shown in table 2, these 10 states accounted for about 77 percent of the unprotected steel mains in 2012.

Table 2: Ten states with highest miles of unprotected steel natural gas distribution mains, 2012

State	Miles of distribution mains	Percentage of distribution mains in state	Miles of distribution mains as a percentage of nationwide total
Ohio	9,044	16%	14.7%
Pennsylvania	8,086	17%	13.2%
New York	6,900	14%	11.3%
Texas	6,100	6%	9.9%
California	5,269	5%	8.6%
Kansas	3,487	16%	5.7%
West Virginia	2,963	28%	4.8%
Oklahoma	1,857	7%	3.0%
Massachusetts	1,780	8%	2.9%
New Jersey	1,708	5%	2.8%
Total	47,194		76.9%

Source: OIG analysis of PHMSA data.

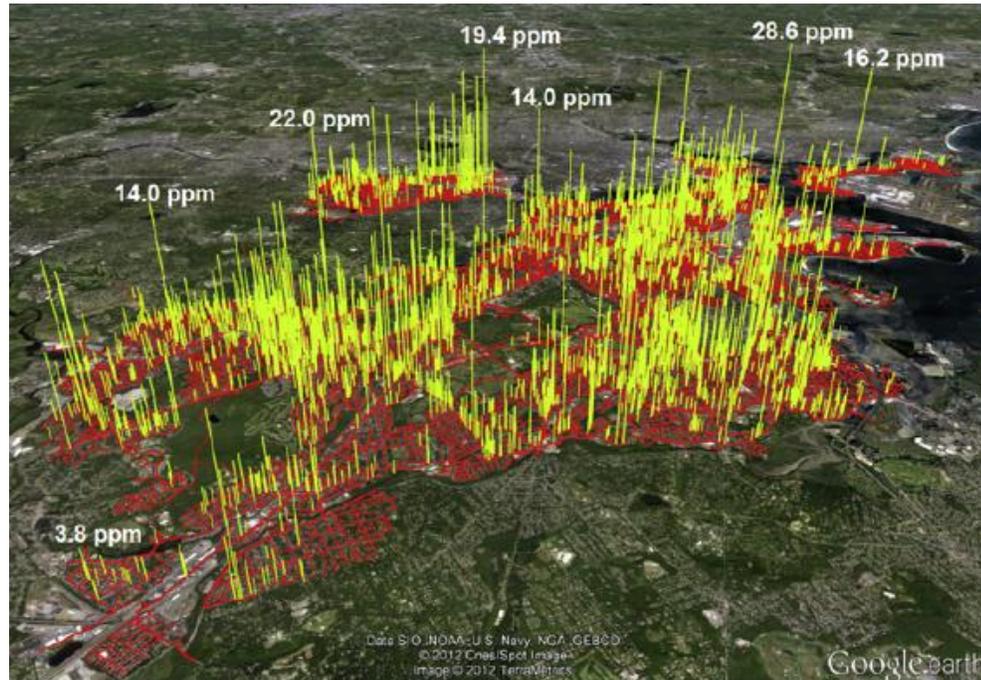
As shown in tables 1 and 2, four states are among the 10 highest for both miles of cast and wrought iron as well as unprotected steel pipelines (Massachusetts, New Jersey, New York and Pennsylvania).

Aging Infrastructure Associated With Large Number of Methane Leaks From Urban Pipelines

A 2013 study identified more than 3,000 methane leaks believed to be from distribution pipelines in the city of Boston.⁵ In the study, researchers used mobile detection equipment to identify leaks, determine the concentration of the leaks, and map the leaks according to a specific location. The study concluded that the leaks were primarily from cast iron distribution mains, some of which were more than 100 years old. While the study was able to identify leaks and measure their concentration at a certain point in time, it did not measure the total amount of methane that was being emitted from the leaks. Therefore, the actual amount of methane released from these leaks is unknown. Figure 2 shows the leaks that were detected by the researchers in Boston, along with their corresponding concentrations.

⁵ "Mapping Urban Pipeline Leaks: Methane Leaks Across Boston," *Environmental Pollution*, 173 (2013) 1-4.

Figure 2: Methane leaks in the city of Boston, shown as concentrations (in parts per million)



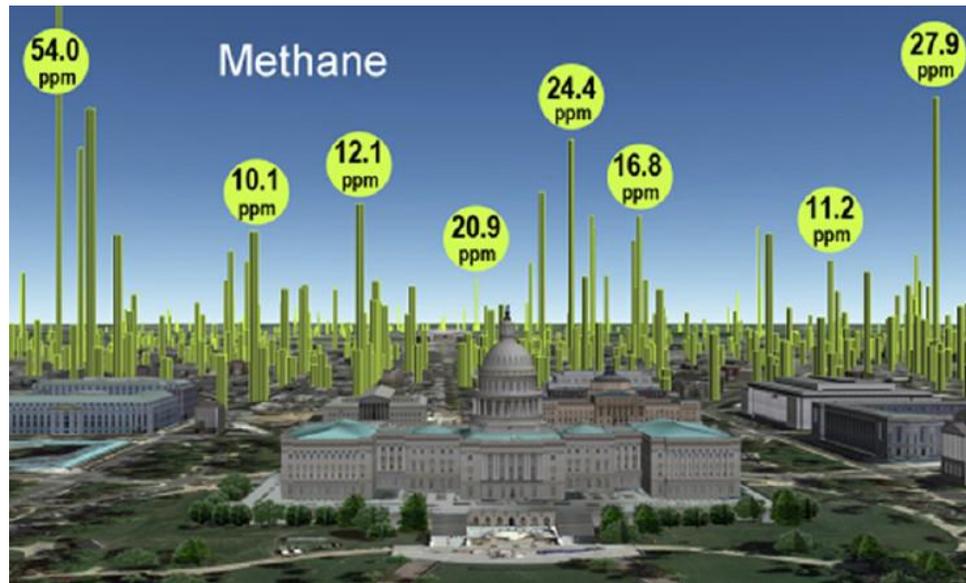
Source: Reprinted from *Environmental Pollution*, Vol 173, Nathan G. Phillips et al., Mapping urban pipeline leaks: Methane leaks across Boston, 1-4, Copyright (2013), with permission from Elsevier.

Note: Methane leaks (3356 yellow spikes > 2.5 ppm) mapped on Boston's 785 road miles (red) surveyed in this study.

In a second study published in 2014 and conducted in Washington, D.C., researchers found results similar to the Boston study.⁶ They identified more than 5,800 methane leaks in Washington. Like Boston, the researchers associated the high level of leaks in Washington with an aging cast iron pipeline infrastructure. Figure 3 shows detected leaks in a section of Washington, along with their corresponding concentrations.

⁶ "Natural Gas Pipelines Leaks Across Washington, D.C.," *Environmental Science & Technology*, 48(3), 2051-2058.

Figure 3: Methane leaks in Washington, D.C., shown as concentrations (in parts per million)



Source: Reprinted with permission from Robert B. Jackson, et al., Natural Gas Pipeline Leaks Across Washington, DC, *Environmental Science and Technology*, 48(3), 2051–2058, Copyright (2014) American Chemical Society.

Note: A close-up of leaks near the U.S. Capitol Building showing high leak densities east of the building but few leaks over the National Mall, where very few natural gas pipelines exist.

EPA Authority to Regulate Methane

The Supreme Court ruled in *Massachusetts v. EPA* (2007)⁷ that GHGs are pollutants covered by the Clean Air Act (CAA), and that the EPA has the authority to regulate GHG emissions from new motor vehicles under Section 202(a)(1) of the Act. The court also instructed the EPA to determine, in accordance with provisions in the Act, whether emissions of GHGs from new motor vehicles cause or contribute to air pollution, which may reasonably be anticipated to endanger public health or welfare, or provide a reasonable explanation why it could not reach a decision.

In 2009, the EPA issued the Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the CAA (often referred to as the Endangerment Finding). Specifically, the EPA Administrator determined that:

- Six GHGs,⁸ including methane, taken in combination, endanger both the public health and the public welfare of current and future generations.
- GHGs from new motor vehicles and new motor vehicle engines contribute to the GHG air pollution that endangers public health and welfare under CAA Section 202(a).

⁷ 549 U.S. 497 (2007).

⁸ Carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulfur hexafluoride.

After the agency began regulating GHGs from motor vehicles, it issued proposed regulations of GHG emissions from the largest stationary sources.⁹

EPA's Natural Gas STAR is a Voluntary Program to Reduce Methane Emissions

The EPA works with industry partners to voluntarily reduce methane emissions from all sectors of the natural gas industry, from production through distribution, through its Natural Gas STAR program. This program, established in 1993, provides a framework to encourage partner companies to implement methane emission-reducing technologies and practices. It also calls for them to document their voluntary emission-reduction activities and report emission reductions to the EPA. The EPA tracks these reported emission reductions to determine the effectiveness of the voluntary efforts under the Natural Gas STAR program.

Federal Regulations for Safety of Natural Gas Distribution Pipelines

The Department of Transportation's PHMSA regulates natural gas distribution pipelines. The emphasis of PHMSA's regulations in this sector is almost exclusively on safety and the prevention of lost life and property. PHMSA regulations require distribution pipeline operators to conduct periodic leakage surveys and promptly repair any hazardous (i.e., potentially explosive) leaks. In December 2009, PHMSA amended its pipeline safety regulations to require distribution sector operators to develop and implement integrity management programs. Such programs were aimed at improving leak management and damage prevention.

Responsible Offices

The EPA offices having primary responsibility over the issues discussed in this report are the Office of Air and Radiation's (OAR's) Office of Atmospheric Programs and Office of Air Quality Planning and Standards. The Office of Atmospheric Programs is responsible for efforts under the voluntary Natural Gas STAR program, while the Office of Air Quality Planning and Standards is responsible for developing regulations for air pollutants.

Scope and Methodology

We conducted our review from June 2013 through April 2014. We conducted this performance audit in accordance with generally accepted government auditing standards. Those standards require that we obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our

⁹ A *stationary source* is a place or object from which pollutants are released that do not result from an internal combustion engine for transportation purposes, a nonroad engine, or a nonroad vehicle. Stationary sources include power plants, gas stations, incinerators, houses, pipelines, etc.

objective. We believe the evidence obtained provides a reasonable basis for our findings and conclusions based on our objective.

To determine what actions the EPA has taken to reduce methane emissions from leaking pipelines in the distribution sector, we reviewed relevant laws and regulations, including the:

- 1990 CAA, as amended.
- Oil and Natural Gas Sector: New Source Performance Standards (NSPS) and National Emission Standards for Hazardous Air Pollutants (NESHAP).
- Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule.
- Mandatory Reporting of Greenhouse Gases Rule Subpart W - Petroleum and Natural Gas Systems.
- Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards.

We also reviewed data and other documents obtained from the EPA and external parties, including:

- Information on the EPA's Natural Gas STAR program and practices to reduce methane leaks.
- Greenhouse Gas Reporting Program (GHGRP) data and documentation.
- Inventory of U.S. Greenhouse Gas Emissions and Sinks (GHG Inventory) data and documentation.
- Numerous external reports and studies on methane leaks and emissions.

We interviewed EPA managers and staff in OAR's Office of Atmospheric Programs and Office of Air Quality Planning and Standards; the Office of Research and Development; and the Office of General Counsel. We also interviewed representatives from the American Gas Association, BlueGreen Alliance, Conservation Law Foundation, Duke University, Environmental Defense Fund, the Gas Technology Institute, National Association of Regulatory Utility Commissioners, and Picarro.

Chapter 2

EPA Does Not Regulate Methane Emissions From Distribution Pipelines and Voluntary Efforts Have Achieved Limited Reductions

The EPA has not issued regulations to control methane emissions from distribution pipelines, partnered with PHMSA to control such leaks, nor developed a strategy to address barriers that inhibit the mitigation of methane leaks in the natural gas distribution sector. While the Natural Gas STAR program has been successful in reducing methane from other segments of the industry, this voluntary program has achieved limited reductions from leaking distribution pipelines, due largely to financial and policy barriers. For example, LDCs generally have had to bear the upfront capital expenditures to repair leaks, while the savings from these repairs have accrued to the consumer, thus creating a disincentive for LDCs to repair nonhazardous leaks. While the natural gas distribution sector is not the largest emitter of methane, it is one of the industry sectors included in the 2014 interagency methane strategy. The EPA should partner with PHMSA to reduce methane emissions from both a safety and environmental perspective, and develop a strategy to address financial and policy barriers. The EPA also needs to set goals and track its progress in reducing emissions from distribution pipelines through voluntary approaches to determine if future regulation would be appropriate. In addition to contributing to global climate change, methane leaks from distribution pipelines represent more than \$192 million in lost natural gas product annually.

Methane Emissions From Natural Gas Distribution Pipelines Not Currently Regulated by EPA

The EPA does not currently regulate methane emissions from distribution pipelines under the CAA. The EPA does regulate other parts of the natural gas industry under two provisions of the CAA: Section 111 (NSPS), and Section 112 (NESHAP). EPA's NSPS for the natural gas industry limits emissions of criteria pollutants¹⁰ and volatile organic compounds.¹¹ EPA's NESHAP limits emissions of air toxics.¹²

¹⁰ Criteria pollutants include six common pollutants: ozone, particulate matter, carbon monoxide, nitrogen dioxide, sulfur dioxide and lead. These are called *criteria pollutants* because EPA regulates them by first issuing "air quality criteria," which reflect the latest scientific knowledge about the pollutants' effects on public health or welfare, then sets standards for permissible levels of the pollutants in the ambient air to protect against such adverse effects.

¹¹ Volatile organic compounds are emitted as gases from certain solids or liquids. Volatile organic compounds include a variety of chemicals, some of which may have short- and long-term adverse health effects.

¹² Air toxics, also known as hazardous air pollutants, are pollutants that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects. There are currently 187 air toxics listed under CAA Section 112(b).

However, neither the NSPS nor NESHAP address methane emissions directly.¹³ Since natural gas is almost pure methane by the time it reaches the distribution sector, there are no criteria or toxic air pollutants to control. The result is that methane emissions from the distribution sector are not addressed by the EPA's current emission limits for the natural gas industry.

When the EPA issued the revised NSPS and NESHAP for the natural gas industry in 2012, it stated that it “intend[s] to continue to evaluate the appropriateness of regulating methane with an eye toward taking additional steps if appropriate.” The EPA has not made a decision about regulating methane. We estimate that more than \$192 million¹⁴ in natural gas was lost due to distribution pipeline leaks in 2011.

The 2014 interagency methane strategy states that the EPA will issue a series of white papers on potentially significant sources of methane emissions in the oil and natural gas sector during the spring of 2014, and solicit input from independent experts. These white papers were issued in April 2014 and focused on methane and volatile organic compounds emissions from hydraulically fractured oil wells, liquids unloading, pneumatic devices, compressors, and leaks. In the fall of 2014, the EPA is to determine what, if any, regulatory authorities the agency will use to control emissions from these sources. None of the issued white papers address methane emissions from distribution pipelines.

No Local Distribution Companies Have Obtained GHG Permits From EPA

No local distribution companies (LDCs) have obtained GHG permits from the EPA. In general, any facility with potential to emit 100,000 tons per year (tpy) or more of GHG (measured on a CO₂e basis) must obtain a CAA Title V operating permit. Additionally, new facilities with the potential to emit 100,000 tpy or more of GHGs (measured on a CO₂e basis)—and greater than or equal to the applicable major source threshold (i.e., 100 or 250 tpy, depending on the source category) on a mass basis—must generally obtain a Prevention of Significant Deterioration (PSD) pre-construction permit before it can commence construction. Also, existing facilities that plan to undertake modifications that substantially increase their potential to emit GHG's may also be required to obtain a PSD permit for GHG emissions before they can make the modifications.¹⁵

¹³ While neither the NSPS nor NESHAP directly control or address methane emissions, these rules are expected to achieve substantial methane emission reductions as a co-benefit of controlling volatile organic compounds emissions. However, since the regulations do not cover the distribution sector, no methane emission reductions from distribution pipelines are expected as a co-benefit.

¹⁴ This figure is based on the EPA's 2011 GHG Inventory distribution pipeline emissions estimate of 13 MMT CO₂e and the 2011 average city gate price of natural gas of \$5.63 per thousand cubic feet (MMT CO₂e was converted to thousand cubic feet of methane).

¹⁵ EPA provides a thorough discussion of the various GHG permitting requirements in *PSD and Title V Permitting Guidance for Greenhouse Gases* (March 2011), at <http://www.epa.gov/nsr/ghgdocs/ghgpermittingguidance.pdf>.

Thirty-six LDCs reported more than 100,000 tpy of methane emissions to the EPA in 2011. However, none of these companies has obtained a GHG permit. In our view, this is likely due to the fact that methane emissions from distribution pipelines are generally “fugitive” emissions resulting from leaks. Under current EPA policy, fugitive emissions from these facilities are not counted toward the thresholds for determining whether a source is subject to GHG permitting provisions, except for major modifications at sources under PSD requirements per the EPA’s 2013 permitting guidance that cites CAA Section 302(j) and relevant regulatory provisions.¹⁶

EPA Has Not Partnered With PHMSA to Control Methane Leaks

Historically, PHMSA has regulated LDCs’ pipeline infrastructure with a public safety focus rather than an environmental protection focus.¹⁷ PHMSA’s regulations were not designed to mitigate the environmental impacts of leaks. PHMSA requires LDCs to repair or replace leaking pipelines that:

... represent an existing or probable hazard to persons or property and requires immediate repair or continuous action until the conditions are no longer hazardous.

PHMSA regulations leave the repair of non-hazardous leaks to the discretion of the LDC.

According to the Executive Director of BlueGreen Alliance,¹⁸ when LDCs discover a leak, they may vent the leak to the atmosphere instead of repairing it if the leak is not a safety hazard. An LDC may also vent a hazardous leak to reduce the safety threat of the leak, thus reducing its explosive potential and downgrading its hazard rating. If a state does not adopt initiatives to enforce the repair of persistent, non-hazardous leaks, the LDC can potentially allow a non-hazardous leak to vent to the atmosphere in perpetuity.

States vary in their regulations and initiatives to repair non-hazardous leaks. Some states have been proactive in developing initiatives that go beyond PHMSA’s requirements. According to information from the National Association of Pipeline Safety Representatives and National Association of Regulatory Utility Commissioners, in 2013 approximately half of the states had not adopted initiatives that would prevent non-hazardous leaks from persisting in perpetuity. Additionally, 22 states (or specific utilities within the states) have adopted initiatives to replace cast iron and/or unprotected steel pipelines.

¹⁶ Counting GHG Fugitive Emissions in Permitting Applicability (December 12, 2013); EPA guidance document addressing questions about GHG permitting at <http://www.epa.gov/nsr/ghgqa.html>.

¹⁷ PHMSA has federal oversight of the natural gas distribution network; PHMSA’s focus is on safety and the prevention of loss of life.

¹⁸ The BlueGreen Alliance is an organization that represents 14 of the largest unions and environmental groups in the United States.

The EPA has not partnered with PHMSA to address leaks from a combined safety and environmental standpoint. EPA staff told us that they do not have a formal partnership with PHMSA, and PHMSA last participated in an EPA Natural Gas STAR workshop in 2009. The lack of coordinated action between the EPA and PHMSA hinders an effective partnership where PHMSA's technology and regulations could be used to produce additional environmental benefits. The EPA has the opportunity to partner with PHMSA in implementing the 2014 interagency methane strategy.

EPA's Voluntary Program Has Achieved Limited Emission Reductions From Natural Gas Distribution Pipelines

The EPA works with natural gas industry partners to voluntarily reduce their methane emissions through the Natural Gas STAR program. The emission reductions achieved by the Natural Gas STAR program for the distribution sector, as reported by partner companies, has been limited in comparison to other segments of the natural gas industry. In 2012, the Natural Gas STAR program achieved a total of 66 billion cubic feet in methane emissions reductions from the natural gas industry. Reductions from the distribution sector accounted for only 1 percent of this. In comparison, reductions from the production sector accounted for 82 percent, and reductions from the transmission sector accounted for 15 percent. Further, since 1993, the cumulative amount of methane emissions reduced from the distribution sector through 2012 was 45.4 billion cubic feet, compared to 255.9 billion cubic feet for the transmission sector. In addition, as of 2012, emissions from the production sector had been reduced by 819.4 billion cubic feet since 1990.

The Natural Gas STAR program has identified several technologies or practices that LDCs can voluntarily adopt to reduce methane leaks in the distribution sector. These include:

- Inserting flexible plastic liners inside existing cast iron and unprotected steel pipeline. Plastic leaks less than cast iron and unprotected steel, and its installation is less costly and disruptive than replacing existing pipe with new pipeline.
- Using composite wrap to repair defects—such as pits, dents, gouges and external corrosion—to prevent leaks. Installation of composite wrap can be performed on an operating pipeline without taking it out of service.
- Using directed inspection and maintenance to find and fix significant leaks based upon an inspection schedule. Through a directed inspection and maintenance program, LDCs monitor and inspect components prone to leak enough methane to make repairs cost effective. LDCs use special infrared cameras to detect methane emissions from hundreds of components.

The Natural Gas STAR program shares and publicizes these technologies and practices through its website, newsletters and technology transfer workshops in an

effort to promote and increase their use among partner companies. However, the low level of emission reductions achieved to date from this sector suggests that the use of these technologies and practices is limited and could be expanded.

Financial and Policy Barriers Hinder Methane Emission Reductions From the Distribution Sector

The limited emission reductions achieved by the distribution sector are due in large part to the fact that LDCs have little financial incentive to reduce methane emissions from leaking pipelines that do not pose a potential safety hazard. LDCs typically do not own the gas that flows through their pipeline networks. LDCs are generally allowed to pass on to their customers the costs of gas that is “lost and unaccounted for” from the pipeline system, including gas lost to leaks. The benefits of repairing leaks (i.e., gas savings) are passed on to the consumer. Thus, there is a financial disincentive for LDCs to proactively locate and repair leaks. The cost of the product lost (i.e., natural gas) is easy for LDCs to recover while the costs to repair, replace or retrofit pipelines poses more of a cost recovery challenge.

State public utility commissions (PUCs) regulate the rates and services of LDCs. Their policies can create barriers to reducing methane emissions from leaking pipelines. Repairing or replacing pipeline involves significant capital investments, and the LDC generally has to carry these costs until they can be recovered. Cost recovery is usually not permissible until after the filing of a rate case, a proceeding through which an LDC applies to the PUC for a rate increase. A rate case can create a “regulatory lag” in that the LDC is responsible for bearing the costs of pipeline replacement and repair until the rate increase takes effect and the LDC begins to recover its costs.

Another barrier to replacing and repairing pipeline involves the traditional practice of charging customers for the amount of gas used based on a per-unit price (such as dollars per kilowatt hour). This practice promotes pipeline expansion rather than repair and replacement because expansion will increase the LDCs customer base, resulting in more gas sold and revenue earned. Conversely, investing in improvements to existing infrastructure will lead to increased gas rates, which will deter consumption and potentially result in lost revenue for the LDC.

In recognition of these financial and policy barriers, some PUCs have taken steps to improve cost recovery mechanisms for their LDCs. PUCs have to balance goals—such as ensuring consumers receive safe and reliable service at reasonable rates—while allowing LDCs an opportunity to earn a fair rate of return. There are a number of financing mechanisms that allow LDCs to recover capital expenditures for fixing leak-prone pipelines on an annual basis. These mechanisms can decrease LDCs’ capital recovery times and diminish the disincentives to repair and replace leaking pipelines.

The EPA does not have a strategy to address the financial and policy barriers that inhibit the mitigation of methane leaks in the natural gas distribution sector. The EPA's Fiscal Year 2011–2015 Strategic Plan proposes to “reduce the threats posed by climate change by reducing GHG emissions” through cost-effective voluntary programs (like Natural Gas STAR). Natural Gas STAR representatives told us they have limited options to address methane leaks in the distribution sector because of the financial and policy barriers.

According to the EPA's Strategic Plan, voluntary programs play a key role in reducing GHG emissions. However, the EPA's Strategic Plan does not contain strategic measures or performance goals for reducing methane from leaking pipelines. Such measures and goals are a critical first step in providing a framework for accountability, results and monitoring of voluntary program effectiveness.

Natural Gas STAR representatives told us PUCs could play a key role in reducing methane emissions from the distribution sector. They said the Natural Gas STAR program could work with PUCs in developing a new financial model. A financial model that alters the current incentive structure of LDCs to proactively repair more leaks should help the EPA's voluntary programs achieve results.

Conclusions

The EPA does not currently regulate methane emissions from distribution pipelines, and the agency's voluntary efforts have achieved limited reductions from this sector. In addition to contributing to global climate change, methane leaks from distribution pipelines represent more than \$192 million in lost natural gas product annually, a cost borne by consumers. The 2013 Climate Action Plan and its associated 2014 interagency methane strategy provide the foundation for increased EPA effort and attention to methane emissions from distribution pipelines. The EPA needs to develop a strategy to address financial and policy barriers that hinder voluntary emission reductions in the sector. The EPA could maximize its emission reductions by focusing on states that have the highest amount of cast iron and unprotected steel pipelines and do not have initiatives to replace these pipelines. Additionally, establishing transparent goals and measures for the agency's voluntary program will aid future determinations about the need to regulate methane emissions from distribution pipelines.

Recommendations

We recommend that the Assistant Administrator for Air and Radiation:

1. Address methane emissions from the natural gas distribution sector as part of the agency's efforts to carry out the 2013 Climate Action Plan and associated 2014 interagency methane strategy. Specifically, as part of the interagency methane strategy, the EPA should work with the Department

of Transportation's PHMSA to address methane leaks from a safety and environmental standpoint.

2. Develop and implement a strategy to address the financial and policy barriers to repairing methane leaks from distribution pipelines. This strategy should include partnering with state PUCs to overcome barriers, and consider regional/state pipeline infrastructure and policy variations.
3. Establish annual performance goals for reducing methane emissions from distribution pipelines through the EPA's voluntary programs, such as Natural Gas STAR, and report annually in the EPA's Annual Performance Report the agency's progress in meeting these goals.
4. Assess annually whether the above annual performance goals are being met and, if not, determine whether changes or modifications in voluntary programs and other options available to the EPA are needed, including whether regulating methane emissions from the distribution sector would be appropriate under the CAA.

Agency Comments and OIG Evaluation

The agency agreed with recommendations 1 and 2 and provided acceptable planned corrective actions and completion dates that meet the intent of these recommendations. For recommendation 1, the agency plans to enhance its collaboration with PHMSA to reduce leaks from the distribution sector through implementation of the 2014 interagency methane strategy. For recommendation 2, the agency plans to collaborate with the Environmental Council of the States to identify opportunities to reduce methane emissions from the distribution sector. This includes participating in the Environmental Council of the States' Shale Gas Council, through which the EPA will engage states in discussions about methane emission reductions. OAR also plans to engage in discussions with the Downstream Initiative, which was identified in the 2014 interagency methane strategy, and to work with PUCs to focus on ways to overcome obstacles to reducing emissions in the distribution sector. Recommendations 1 and 2 are resolved and open with corrective actions ongoing.

The agency partially agreed with recommendation 3. It stated that it already tracks voluntary methane emission reductions through the Climate Protection Partnerships Annual Report and the U.S. Climate Action Report. However, the measures in these reports are for methane emissions as a whole, and are not specific to the distribution sector. The agency also stated that it already has an annual performance goal for Industrial Sector Programs that tracks and assesses progress through voluntary efforts to reduce GHG emissions. However, this measure is not specific to the Natural Gas STAR Program nor the distribution sector, and includes GHG emissions other than methane. We acknowledge that the EPA provides information on methane emissions from the distribution sector on its Natural Gas STAR

website, but these emissions are not tracked over time. Rather, they present overall emissions for only 1 year. Thus, none of these measures tracks progress in reducing methane emissions from the distribution sector alone. We believe that combining distribution sector emissions with emissions from other sectors masks what is actually occurring in the distribution sector. Further, given the lack of incentives and the unique disincentives in the distribution sector, we believe that a measure that tracks progress for the distribution sector alone is warranted. Therefore, recommendation 3 is unresolved.

For recommendation 4, the agency stated that it would continue its efforts to evaluate data and assess potential opportunities that could be taken to further address emissions from the distribution sector. While we support the agency's efforts to continuously assess opportunities to address these emissions, to meet the intent of this recommendation, the EPA needs to develop a performance measure for the distribution sector alone that assesses progress in meeting established goals for reducing methane emissions. Progress should then be monitored using this distribution sector-specific measure. Therefore, recommendation 4 is unresolved.

Appendix A contains the agency's response to recommendations 1, 2, 3 and 4 and its proposed corrective actions.

Chapter 3

EPA's Methane Emissions Data for Natural Gas Distribution Pipelines Need to Be Improved

There is significant uncertainty in the EPA's current methods for estimating methane emissions for the distribution sector. The EPA estimates methane emissions for the distribution sector using the GHG Inventory and the GHGRP. Emission estimates from both programs are developed using emission factors (EFs) that are based on data from a 1996 EPA and Gas Research Institute (GRI) study. Uncertainties in these EPA/GRI EFs raise questions about the validity of the EFs and, therefore, the accuracy of the distribution sector's methane emissions reported in the GHG Inventory and GHGRP. Findings from recent research not funded or sponsored by the EPA suggest that methane emissions from distribution pipelines may be higher or lower than EPA's current estimates. The EPA has not conducted its own studies or sponsored external studies to re-evaluate the distribution pipeline EFs from the EPA/GRI study. Instead, the EPA has been focusing on updating EFs for other sectors of the natural gas industry, such as production and processing. Effective methane reduction strategies may be difficult to develop without better estimates of methane emissions from this sector.

EPA Uses Emission Factors to Estimate Methane Emissions

The EPA estimates methane emissions through both the GHG Inventory and the GHGRP. Both of these EPA programs rely on distribution pipeline EFs¹⁹ based on data from the 1996 EPA/GRI study to estimate distribution sector methane emissions. The 1996 study calculated leak rates for several different kinds of distribution pipelines (cast iron, unprotected steel, protected steel, plastic and copper). The EPA later used the leak rates from the 1996 study to develop the distribution pipeline EFs it uses in the GHG Inventory and GHGRP.²⁰

¹⁹ The EPA defines *EF* as a representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant. In most cases, these EFs are simply averages of all available data of acceptable quality and are generally assumed to be representative of long-term averages for all facilities in the source category (i.e., a population average). For the natural gas distribution sector, EPA/GRI developed EFs for distribution lines made of unprotected steel, protected steel, plastic, cast iron and copper.

²⁰ When we refer to EFs in this chapter, we are referring to the distribution pipeline EFs that the EPA developed based on the 1996 data to estimate emissions for the GHG Inventory and GHGRP.

EPA's GHG Inventory

The GHG Inventory is an annual report—with data compiled by EPA staff—that tracks total annual U.S. emissions and removals²¹ by source, economic sector and GHG going back to 1990. The EPA uses national energy data, data on national agricultural activities and other national statistics to provide a comprehensive “bottom-up” estimate²² of total GHG emissions for all man-made sources in the United States.

To estimate methane emissions from distribution pipelines for the GHG Inventory, EPA staff generally use the EFs based on the 1996 EPA/GRI study. The EFs for distribution mains are applied to the miles of pipeline of each type of material used²³ (i.e., plastic, cast iron, unprotected steel and protected steel) to generate emission estimates from all mains. The EFs for distribution services are applied to the number of service lines of each type of material used to generate emission estimates from all service lines. Once the EPA has added these totals together for a gross estimate, it subtracts out emission reductions achieved from the Natural Gas STAR program to account for reductions resulting from the program's voluntary efforts. For 2011, EPA staff estimated methane emissions from natural gas distribution pipelines to be about 14 MMT CO₂e.

EPA's GHG Reporting Program

Large emission sources and fuel suppliers are required to report their GHG emissions data under EPA's GHGRP.²⁴ The GHGRP has a reporting threshold of 25,000 metric tons of CO₂e. Only those LDCs that meet or exceed the threshold must report methane emissions to the EPA. A key difference from the GHG Inventory is that GHGRP data are reported to the EPA by those facilities meeting the threshold limits. Still, the GHGRP requires that LDCs use the EFs that are based on the 1996 EPA/GRI study, multiplied by miles/number of each type of pipeline within their systems. For 2012, GHGRP facilities reported that their distribution pipelines emitted about 12 MMT CO₂e.

Validity of EPA's Emission Factors for Distribution Pipelines Uncertain

Our review of the 1996 EPA/GRI study of distribution pipelines found that there was significant uncertainty in the study data due to small sample sizes and widely

²¹ *Removal* refers to the ability to take up, as opposed to emit, GHG emissions. This occurs due to *sinks* (for example, trees or crops), which are resources or processes that remove atmospheric GHGs from the air.

²² A *bottom-up* estimate is derived by adding together estimates of individual anthropogenic sources. *Top-down* approaches, on the other hand, involve atmospheric measurements and the use of meteorological data and statistical analyses to trace atmospheric concentrations back to individual sources.

²³ The EPA obtains data on miles of pipeline from PHMSA.

²⁴ Most source categories began reporting yearly GHG data with the 2010 reporting year and these 2010 data were reported to the EPA by September 2011. Additional source categories began reporting yearly GHG data with the 2011 reporting year and these 2011 data were reported to the EPA by September 2012.

varying leak measurements. The 1996 study included only 21 samples from cast iron mains, 20 samples from unprotected steel mains, 17 samples from protected steel mains, and six samples from plastic mains. The sample sizes for distribution service lines were similar, ranging from 24 for protected steel service lines to four for plastic service lines. In addition, the study produced a wide range of measurements, resulting in uncertainty about the true leak rate. For example, the study authors concluded that the average emission factor for cast iron mains was 238,736 standard cubic feet (scf) per mile of pipeline per year (scf/mile-year),²⁵ with a 90-percent confidence interval of +/-152,059 scf/mile-year. This means there was only 90-percent confidence that the true average emission rate fell within a very large range of values (from 86,677 scf/mile-year to 390,795 scf/mile-year).

As of 2012, there were more than 32,000 miles of cast iron mains in the United States. Therefore, current emission estimates based on the 1996 EPA/GRI average emission factor for cast iron mains may be much higher or lower than actual emissions.

The 1996 EPA/GRI study also reported a surprisingly high leakage rate for plastic mains, the type of pipe generally viewed as the least leak-prone. The study concluded that the average leak rate for plastic mains is 12.45 scf per leak per hour (scf/leak-hour). This rate is significantly higher than the study's estimate for unprotected steel mains, which are known to corrode and leak over time. According to the study, the relatively high average leakage rate for plastic mains was due to the small sample size (only six samples) and one large data point that skewed the overall average leak rate. The data points for the plastic mains sampled ranged from 0.008 scf/leak-hour to 61 scf/leak-hour, a span of five orders of magnitude. As a result, there is more uncertainty in the EPA/GRI average leak rate for plastic mains than for any other type of distribution pipe.

In 2005, in response to comments that the 1996 EPA/GRI emission factor for plastic pipelines was unreasonably high, the EPA researched additional data sources and found a study by the Southern California Gas Company that contained seven leak measurements at plastic pipelines. This data showed a leak rate that was a little more than half of what EPA/GRI had measured for the 1996 study. The EPA weight-averaged this data with the 1996 EPA/GRI data for plastic pipelines to improve the original EF. This adjusted EF for plastic pipelines is now used in the GHG Inventory and GHGRP. However, EPA has not adjusted the EFs for cast iron mains, unprotected steel mains or protected steel mains.

Recent Emissions Data From the Gas Technology Institute

Results of a recent Gas Technology Institute (GTI)²⁶ study indicated that the EPA/GRI EF for plastic mains significantly overestimates emissions. GTI found a

²⁵This was the average EF after EPA/GRI adjusted it to account for soil oxidation.

²⁶ The GTI was formerly the GRI and the Institute of Gas Technology.

leak rate for plastic mains of 3.72 scf/leak-hour versus EPA/GRI’s average leak rate of 12.45 scf/leak-hour.

Table 3 shows a comparison of the 1996 EPA/GRI and 2013 GTI study results. It compares number of samples, estimated leak rate for plastic mains, minimum leak rate measured, maximum leak rate measured, and the 90-percent confidence interval. It demonstrates that the 2013 GTI study design yielded a much smaller range with respect to the 90-percent confidence interval. Thus, the 2013 GTI study was more precise in its estimated leak rate for plastic mains.

Table 3: Comparison of study results for plastic mains

Study	Samples tested	Est. leak rate (scf/leak-hour)	Min. value (scf/leak-hour)	Max. value (scf/leak-hour)	90-percent confidence interval (scf/leak-hour)
1996 EPA/GRI	6	12.45 ^a	0.008	61.0	+/- 19.81
2013 GTI	22	3.72	0.600	14.4	+/- 1.41

Source: OIG analysis of (1) “Methane Emissions from the Natural Gas Industry, Volume 9 – Underground Pipelines,” EPA and GRI, June 1996; and (2) “Improving Methane Emission Estimates for Natural Gas Distribution Companies, Phase II–PE Pipes,” GTI, November 2013.

^a This leak rate is from the 1996 EPA/GRI study and does not reflect the EPA’s 2005 adjustment to the plastic pipeline EF. The EPA uses the adjusted leak rate for plastic pipelines in the GHG Inventory and GHGRP.

Two Recent External Reports Questioned EPA’s Emissions Data for Distribution Pipelines

A 2012 report²⁷ from Cornell University stated that emission estimates based on the 1996 EPA/GRI study are too low. The authors questioned why the 1996 EPA/GRI emission factors were based on emissions from facilities run by companies that voluntarily participated, rather than a random sample or comprehensive assessment of actual industry practices. Further, the authors stated that distribution systems in some cities are 80 to 100 years old, yet such systems were not included in the 1996 EPA/GRI assessment.

A 2013 report from Gas Safety Incorporated²⁸ raised questions about the usefulness of the EPA’s EFs for distribution pipelines and emission estimates for this sector. In its report, Gas Safety Incorporated noted issues similar to those discussed in the previous section regarding the precision of the EPA/GRI data. The report concluded that:

Estimates generated using the EPA/GRI 1996 method have such a wide confidence interval (±65 %) that their general accuracy and usefulness is questionable.

²⁷ Robert W. Howarth, Renee Santoro, and Anthony Ingraffea, “Venting and leaking of methane from shale gas development: response to Cathles et al.,” *Climatic Change* (journal), February 2012.

²⁸ Bryce F. Payne Jr. and Robert Ackley, “Extended Report on a Preliminary Investigation of Ground-Level Ambient Methane Levels in Manhattan, New York City, New York,” Gas Safety Incorporated, March 2013.

The authors ultimately concluded that existing methane emission estimates, or methods for estimating emissions, have little basis in actual data.

Recent Reports Describe a High Level of Uncertainty Regarding Methane Emissions Estimates

In its 2011 GHG Inventory report, the EPA stated that there is a lack of data or an incomplete understanding of how emissions are generated for some emissions categories. These factors increase the uncertainty associated with certain estimates presented. In our discussions with EPA staff, they confirmed that methane is one of the emissions categories with relatively high uncertainty.

The EPA's uncertainty range relative to its 2011 national methane source estimate from natural gas systems is from -19 percent on the lower end to +30 percent on the upper end.²⁹ The 2013 GHG Inventory report further states that improving the accuracy of EFs could help reduce uncertainty in the GHG Inventory. It states that:

... the accuracy of current emission factors applied to [methane]... emissions from stationary and mobile combustion is highly uncertain.

A February 2014 report³⁰ on methane emissions across all sectors, including the distribution sector, noted that emission inventories are under-predicting atmospheric methane, in part, because:

... measurements for generating emission factors are expensive, which limits sample sizes and representativeness. Many EPA EFs have wide confidence intervals. And there are reasons to suspect sampling bias in EFs, as sampling has occurred at self-selected cooperating facilities.

According to the report:

Given the cost of direct measurements, emissions inventories will remain useful for tracking trends, highlighting sources with large potential for reductions, and making policy decisions. However, improved inventory validation is crucial to ensure that supplied information is timely and accurate.

Similarly, the 2014 interagency methane strategy issued under the 2013 Climate Action Plan stated that better methane emissions data collection and measurement would improve the nation's understanding of methane

²⁹ The EPA did not produce an uncertainty estimate specifically for the natural gas distribution sector.

³⁰ Brandt, et. al., "Methane Leaks from North American Natural Gas Systems," *Science* (journal), February 2014.

sources and trends, and enable more effective management of emissions reduction activities. The strategy listed the following as a key step to improve data quality:

Addressing areas of higher uncertainty in bottom-up inventories through additional data collection, direct emission measurement, and research and analysis.

The strategy specifically calls for an assessment of current methane emissions data and states that improvement opportunities exist with current EFs and other input data.

EPA Has Not Comprehensively Re-Evaluated Its Natural Gas Distribution Pipeline Emission Factors

The EPA has not conducted any direct measurement studies on distribution pipeline emissions since the 1996 EPA/GRI study. As described earlier, the EPA made an adjustment in 2005 to the plastic pipeline emission factor used in the GHG Inventory and GHGRP. However, the EPA has not comprehensively evaluated the 1996 EPA/GRI distribution pipeline emission factors. GTI told us that the 1996 study methodology is not a practical way to obtain additional data since pipelines have to be excavated to obtain leak rates. The EPA has not committed resources toward developing a new methodology to estimate distribution pipeline leaks. Rather, the EPA has focused on quantifying and addressing upstream emissions from the gas industry, such as emissions from natural gas production.

EPA's Attempt to Sponsor an External Study on Distribution Sector Emissions Ended Without Results

The EPA made one attempt to sponsor an external study to update 1996 EPA/GRI distribution sector EFs. In 2008, the EPA awarded a grant of close to \$500,000 to the University of Texas to update EFs for the following source categories:

- Production (well clean-ups, completion flaring, well workovers and pipelines leaks).
- Processing (fugitive emissions from reciprocating and centrifugal compressors).
- Transmission and storage (fugitive emissions from reciprocating and centrifugal compressors, pneumatic devices, and meter and regulating stations).
- Distribution (residential customer meters, plastic mains and services).

However, EPA staff told us that due to limitations related to time and scope, the study did not review EFs for the distribution sector. Instead, the study focused on emissions from production (gathering/boosting), processing (reciprocating and

centrifugal compressor components), and gas transmission. The study's measurements produced lower EFs than the previous EPA/GRI study for some gas system components and higher EFs for other components. The study did not provide the EPA with updated emissions information for distribution systems. According to EPA staff, the EPA has not sponsored other studies on distribution sector emissions.

EPA's Involvement in External Studies to Evaluate Distribution Pipeline Emission Factors Has Been Limited

There are recent and ongoing studies whose results could help the EPA validate and/or update its EFs for distribution sector leaks. However, EPA staff told us they were not involved in developing the studies' design or protocols. Therefore, the agency does not know how useful the studies will be for updating its distribution pipeline EFs. Two studies that could be informative for the EPA are:

- *GTI study* – GTI is currently conducting a multi-phased project targeting distribution sector emissions. Phase I of this project developed a methodology to update leak rate data and EFs for buried distribution piping. Phase II updated the leak rate for plastic distribution pipe. These results have been shared with EPA staff. Phase III will update the leak rate data and EFs for cast iron and unprotected steel distribution mains. Phase III data collection has commenced and is planned to continue through the first half of 2014.
- *Environmental Defense Fund (EDF)* – EDF is partnering with industry and university researchers to study distribution sector leaks. There are three components to this study, including: (1) a top-down study in Boston looking at how much of the atmospheric methane is from distribution; (2) a bottom-up study conducted in multiple cities, measuring leaks from local distribution pipelines; and (3) a study to quantify local distribution leaks and associated leak flux rates using drive-by technology.

According to EPA staff, the EPA's involvement in these studies has been limited. At the time we conducted our review, EPA staff had just recently received the GTI report on plastic distribution pipelines and had not yet evaluated it. In the most recent GHG Inventory, EPA mentions the GTI and EDF studies and states that:

EPA looks forward to reviewing information and data from these studies as they become available for potential incorporation in the Inventory. For example, EPA anticipates reviewing upcoming data on transmission and storage, and distribution system emissions for potential updates to the 1990–2013 Inventory report.

According to GTI representatives, updates to the original distribution pipeline EFs are warranted to reflect changes in operating, leak detection and mitigation

practices. GTI also stated there was a need to increase the sample size of the data. According to GTI, many of these issues are reflected in their current research to update the EFs for distribution pipelines.

Conclusions

The EPA's existing methane emissions data for distribution pipelines may not be valid. Methane emissions from these pipelines may be higher or lower than currently estimated by the EPA. This makes the EPA's assessment and decisions regarding the magnitude and relative importance of these emissions difficult. The EPA has stated its intent to evaluate the appropriateness of regulating methane, and potentially important data on methane emissions are becoming available from GTI and EDF. Further, the 2014 interagency methane strategy issued under the Climate Action Plan calls for the EPA to assess current methane emissions data and the emission factors upon which the data is based. In our view, this assessment should include emission factors for distribution pipelines. The EPA needs to examine the design of the GTI and EDF studies and evaluate the data to determine their usefulness for validating and/or updating its distribution pipeline EFs. The EPA should also be more proactive in identifying opportunities to be involved in such studies in the future. By participating upfront in the design of studies, the EPA increases the likelihood that the study results may be useful to the agency in verifying and/or updating its emission factors.

Recommendation

We recommend that the Assistant Administrator for Air and Radiation:

5. Review data from existing and ongoing studies (as they become available) to determine whether the data can be used to verify and/or update existing emission factors, and document the rationale for determination of usability. If the data can be used, update emission factors as appropriate. If not, the EPA should proactively identify opportunities to work with the research community to obtain the data needed to update the distribution sector emission factors.

Agency Comments and OIG Evaluation

The agency agreed that it is important to review data from existing and ongoing studies (such as the EDF and GTI studies) as they become available to determine if the new information can be used to update existing emission factors. The agency views its GHG Inventory annual review process and efforts underway in implementing the 2014 interagency methane strategy as opportunities to engage with stakeholders in the continued review and evaluation of distribution sector studies. However, the agency's planned corrective actions do not meet the intent of recommendation 5. The EPA has not provided a proposed corrective plan to document its rationale for not using the data from existing and ongoing studies to

update its distribution sector EFs (if such a decision is reached). Also, EPA has not provided a proposed corrective plan for identifying opportunities to work with the research community to obtain data should the GTI and EDF study data not be adequate for verifying/updating existing distribution sector EFs. Therefore, recommendation 5 is unresolved.

Appendix A contains the agency's response to recommendation 5 and its proposed corrective actions.

Status of Recommendations and Potential Monetary Benefits

RECOMMENDATIONS						POTENTIAL MONETARY BENEFITS (in \$000s)	
Rec. No.	Page No.	Subject	Status ¹	Action Official	Planned Completion Date	Claimed Amount	Agreed-To Amount
1	14	Address methane emissions from the natural gas distribution sector as part of the agency's efforts to carry out the 2013 Climate Action Plan and associated 2014 interagency methane strategy. Specifically, as part of the interagency methane strategy, the EPA should work with the Department of Transportation's PHMSA to address methane leaks from a safety and environmental standpoint.	O	Assistant Administrator for Air and Radiation	12/31/14		
2	15	Develop and implement a strategy to address the financial and policy barriers to repairing methane leaks from distribution pipelines. This strategy should include partnering with state PUCs to overcome barriers, and consider regional/state pipeline infrastructure and policy variations.	O	Assistant Administrator for Air and Radiation	9/30/15		
3	15	Establish annual performance goals for reducing methane emissions from distribution pipelines through the EPA's voluntary programs, such as Natural Gas STAR, and report annually in the EPA's Annual Performance Report the agency's progress in meeting these goals.	U	Assistant Administrator for Air and Radiation			
4	15	Assess annually whether the above annual performance goals are being met and, if not, determine whether changes or modifications in voluntary programs and other options available to the EPA are needed, including whether regulating methane emissions from the distribution sector would be appropriate under the CAA.	U	Assistant Administrator for Air and Radiation			
5	24	Review data from existing and ongoing studies (as they become available) to determine whether the data can be used to verify and/or update existing emission factors, and document the rationale for determination of usability. If the data can be used, update emission factors as appropriate. If not, the EPA should proactively identify opportunities to work with the research community to obtain the data needed to update the distribution sector emission factors.	U	Assistant Administrator for Air and Radiation			

¹ O = Recommendation is open with agreed-to corrective actions pending.
 C = Recommendation is closed with all agreed-to actions completed.
 U = Recommendation is unresolved with resolution efforts in progress.

Agency Response to Draft Report

May 23, 2014

MEMORANDUM

SUBJECT: Response to Office of Inspector General (OIG) Draft Report No. OPE-FY13-0016 "Improvements Needed in EPA Efforts to Address Methane Emissions From Natural Gas Distribution Pipelines," dated April 22, 2014

FROM: Janet G. McCabe
Acting Assistant Administrator

TO: Carolyn Copper
Assistant Inspector General
Office of Inspector General

The EPA's Office of Air and Radiation (OAR) appreciates the opportunity to review and comment on the OIG's draft evaluation report "*Improvements Needed in EPA Efforts to Address Methane Emissions from Natural Gas Distribution Pipelines*" (Project No. OPE-FY13-0016). We appreciate the OIG's observations on the challenges that exist in evaluating and addressing methane emissions from natural gas distribution pipelines.

While we acknowledge the inherent challenge in addressing methane emissions from the oil and gas sector, we also recognize that OAR has made great strides in working across the sector to reduce methane emissions. Through our programs, we have been able to establish a substantial understanding of the technical, policy, and economic issues in this sector, and we have achieved real, tangible methane emissions reductions. We seek always to improve the effectiveness of our programs, and strive to focus our limited resources on the highest priority actions, in terms of expanding our knowledge, increasing the availability and quality of data and, most importantly, reducing emissions that contribute to climate change and are harmful to public health and the environment. As explained more fully below, several of the OIG's recommendations identify activities OAR is already taking. Others suggest additional programmatic activities that we may be able to undertake in the future, as resources and competing priorities permit.

OAR has a robust process of collecting information about methane emissions from the natural gas sector, including the distribution sector, through our Greenhouse Gas (GHG) Reporting Program and our GHG Emissions Inventory. Through our work to develop the inventory each year, we undergo a thorough process of evaluating new data and information, and we outline a strategy for improving data quality. We have promulgated and begun implementing regulations for new and modified sources in the natural gas sector through the 2012 New Source Performance Standards for volatile organic compounds (VOC) emissions, which also reduce methane emissions as an important co-benefit. Our successful voluntary partnership, the Natural Gas STAR Program, has worked collaboratively with industry partners in all sectors across the

natural gas value chain, including the distribution sector, and has identified numerous cost-effective best practices for achieving methane reductions. The Gas STAR Program tracks annual emissions reductions reported by Partners, which is reported in the *Office of Atmospheric Programs: Climate Protection Partnerships Annual Report*. The Gas STAR Program has identified over 50 cost-effective best management practices and technologies to reduce emissions, and has achieved cumulative program methane emission reductions of about 470 million metric tons of carbon dioxide equivalent since 1990.

Most importantly, earlier this year the White House launched a comprehensive *Strategy to Reduce Methane Emissions* under the auspices of the President's Climate Action Plan. That Strategy includes several important elements related to the oil and gas sector, and calls for specific actions by the EPA, the Department of Energy (DOE), the Department of Interior (DOI), and the Department of Transportation (DOT). The Strategy outlines the EPA's work to assess several potentially significant sources of methane and other emissions from the oil and gas sector through a series of white papers, which were released for peer review in April 2014. The Strategy also describes the EPA's plans to bolster its Natural Gas STAR Program through launching a new component of the Partnership program that elicits more robust industry commitments while enhancing transparency and accountability. The Strategy highlights a "Downstream Initiative" that has been developed by industry and environmental groups to address some of the key technical and regulatory factors in the natural gas distribution sector. The strategy also describes important and substantive roles for DOE, DOT, and DOI to reduce emissions from the natural gas sector. The EPA looks forward to working with our sister agencies in implementing this important White House strategy, which identifies the highest priority actions that will reduce emissions from this sector in a holistic and strategic manner.

Below are OAR's responses to the OIG's specific recommendations. In the attachment,³¹ we provide additional detailed comments, including a number of incorrect or inaccurate statements that had been identified in earlier discussions between OIG and OAR staff but were not incorporated into the draft report:

- 1. Address methane emissions from the natural gas distribution sector as part of the agency's efforts to carry out the 2013 Climate Action Plan and associated methane strategy. Specifically, as part of the interagency methane strategy, the EPA should work with the Department of Transportation's PHMSA to address methane leaks from a safety and environmental standpoint.**

Response: OAR agrees that it is important to collaborate with other organizations to address methane leaks from distribution pipelines from both safety and environmental perspectives as we already are. Addressing methane emissions from the oil and gas sector through interagency collaboration is a key goal of the *President's Climate Action Plan: Strategy to Reduce Methane Emissions*. Through implementation of this strategy, OAR will continue its efforts to enhance collaboration with the Pipeline and Hazardous Materials Safety Administration (PHMSA) to discuss best practices for reducing leaks in the distribution sector.

³¹ OAR also provided detailed comments in an attachment to its response to the draft report. We made revisions to our report to address OAR's detailed comments where appropriate.

Planned Completion Date: Fiscal Year (FY) 2015, Quarter (Q) 1

- 2. Develop and implement a strategy to address the financial and policy barriers to repairing methane leaks from distribution pipelines. This strategy should include partnering with state PUCs to overcome barriers, and consider regional/state pipeline infrastructure and policy variations.**

Response: OAR agrees that addressing policy and financial barriers is important to promote voluntary methane reductions from this sector. OAR will continue and enhance our current collaboration with the Environmental Council of the States (ECOS), and with natural gas downstream-focused initiatives to identify opportunities to reduce methane from the distribution sector. For example, OAR is a Partner in the ECOS Shale Gas Caucus and will use that forum to engage with broader discussions with states about methane reductions from the natural gas sector. In addition, OAR is engaging in discussions with the Downstream Initiative, which was identified in the President's *Strategy to Reduce Methane Emissions*, and is working directly with public utility commissions to focus on ways to overcome obstacles in improving the distribution sector.

Planned Completion Date: FY15, Q4

- 3. Establish annual performance goals for reducing methane emissions from distribution pipelines through the EPA's voluntary programs, such as Natural Gas STAR, and report annually in the EPA's Annual Performance Report the agency's progress in meeting these goals.**

Response: OAR is in partial agreement with this recommendation. Based on discussions with OIG staff, it is our understanding that the intent of Recommendation 3 is to establish goals for transparently tracking progress in voluntarily reducing methane emissions from distribution pipelines.

OAR agrees with the importance of transparently evaluating progress through the voluntary programs, and we believe that our current tracking procedures are the most appropriate mechanisms to do so. Therefore, rather than creating a new APG, OAR proposes to continue to evaluate new data, ensure transparency, and track progress in reducing emissions from natural gas pipelines using our current mechanisms.

Planned Completion Date: FY14, Q4

To elaborate further on this topic, OAR already has established procedures in place through the *Office of Atmospheric Programs Climate Protection Partnerships Annual Report* and the U.S. Climate Action Report to track and assess progress through voluntary efforts to reduce GHG emissions. Furthermore, one of the 286 annual performance goals (APG) that the EPA currently reports on in the EPA's Annual Performance Report is an APG for the Industrial Sector Programs, which includes the Natural Gas STAR Program voluntary methane reductions as one component.

The EPA, per direction for the Director of the Office of Budget and the Director of the Office of Planning, Analysis, and Accountability, is working to reduce the number of individually tracked performance goals and we believe that the current reporting in the APG is consistent with the substantive intent of the recommendation.

- 4. Assess annually whether the above annual performance goals are being met and, if not, determine whether changes or modification in voluntary programs and other options available to the EPA are needed, including whether regulating methane emissions from the distribution sector would be appropriate under the CAA.**

Response: OAR is in partial agreement with this recommendation. OAR agrees that it is important to evaluate all relevant emerging information to assess potential future actions, including changes or modifications in voluntary programs or other options available to the EPA. However, the Administrator, through OAR, has the authority and responsibility to determine whether regulatory action is appropriate, independent of the progress of voluntary programs, and in consideration of many factors, including other program priorities and available resources. OAR will continue the efforts already in place to evaluate new data, including from the GHG Reporting Program and outside studies. OAR will also continue to assess information gleaned through collaboration with other Federal agencies, states, and other entities under the auspices of the Interagency *Strategy to Reduce Methane Emissions*. Based on these collective inputs, in keeping with its programmatic function, OAR will assess potential opportunities or actions that could be taken to further address emissions from the distribution sector.

Planned Completion Date: FY 16, Q2

- 5. Review data from existing and ongoing studies (as they become available) to determine whether the data can be used to verify and/or update existing emission factors, and document the rationale for determination of usability. If the data can be used, updated emission factors as appropriate. If not, the EPA should proactively identify opportunities to work with the research community to obtain the data needed to update the distribution sector emission factors.**

Response: OAR agrees that it is important to review data from existing and ongoing studies to determine if new information can be used to update existing emission factors, and indeed is already doing so. As already planned through the GHG Inventory annual review process and efforts underway in implementing the Interagency Methane Strategy, OAR continues to engage with stakeholders as appropriate in continued review of distribution sector studies and ongoing evaluation of data for potential updates to GHG emission factors and estimates.

Completion Date: FY15, Q3

If you have any questions regarding this response, please contact Paul Gunning, Director, Climate Change Division in the Office of Atmospheric Programs at (202) 343-9736.

Attachment

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