

NASA/JPL-Caltech/University of Michigan

# USDOT Gas Transmission Pipeline Standards Leak Detection and Repair CH<sub>4</sub> Connections



# Who is PHMSA - DOT/PHMSA?

U. S. Department of Transportation (DOT)



SLSDC

FTA

FAA

FMCSA

FRA

MARAD

FHWA

NHTSA

PHMSA

Hazardous  
Materials

Office of  
Pipeline  
Safety  
(OPS)



# Genesis of PHMSA

- Natural Gas Pipeline Safety Act – 1968
- Reauthorization – Funding, Congressional Mandates, and Expansion of Laws
  - Hazardous Liquid Pipeline Safety Act of 1979
  - Subsequent Reauthorization Act in 1988, 1992, 1996, 2002, 2006, 2011, 2016, and 2020
  - Each time the scope of what we cover and how we cover it expands – Usually Predicated on some catastrophic event
  - The laws give us the ability to pass and enforce safety regulations.



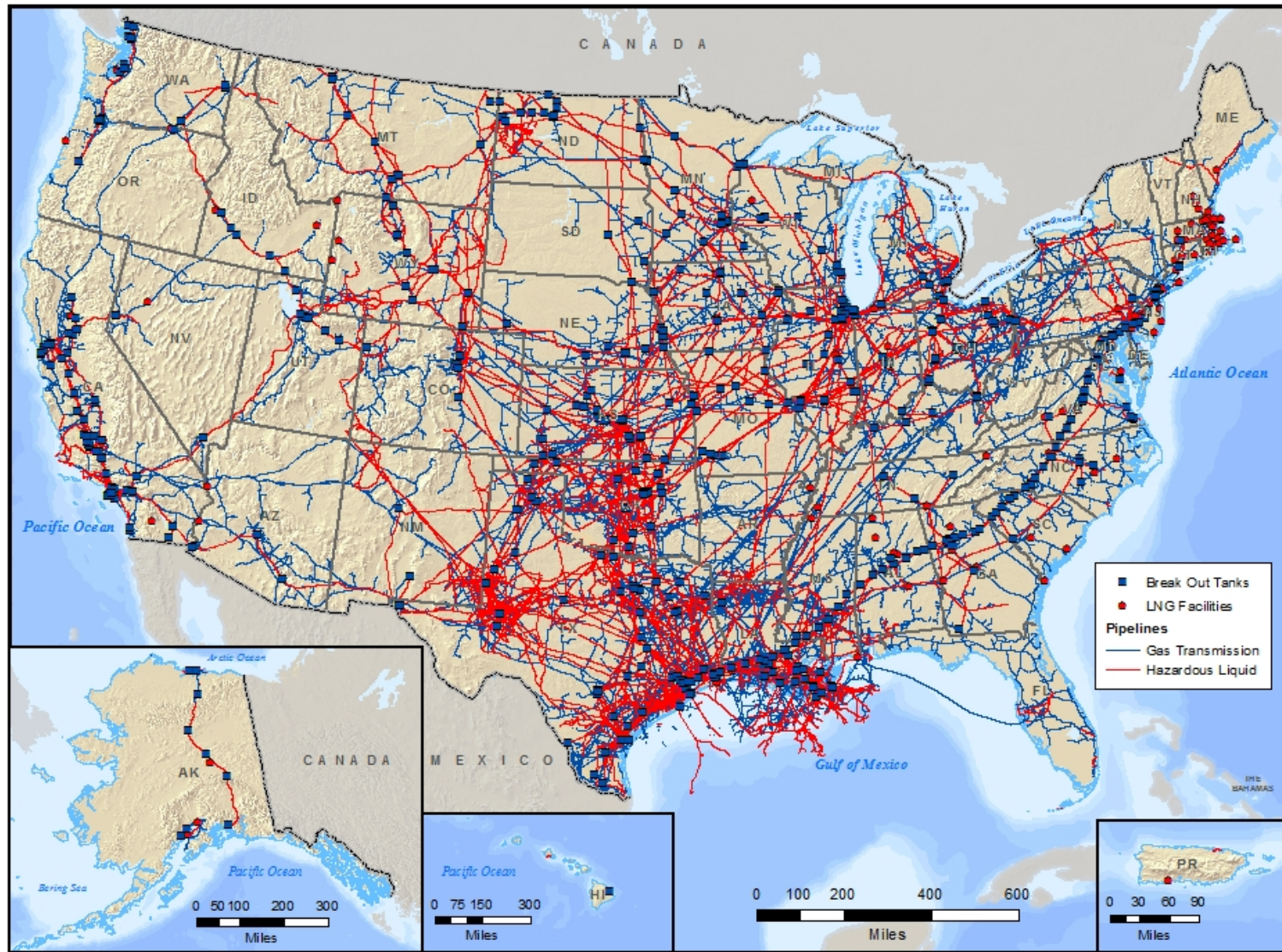
# Our Mission

To protect people **and the environment** from the risks inherent in transportation of hazardous materials – by pipeline and other modes of transportation.



# Gas Transmission and Hazardous Liquid Pipelines in the United States

## National Pipeline Mapping System



U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration  
Projection: Albers Equal Area Conic  
Map created December, 2014



# PHMSA Regulated Pipeline Facilities OPS and States

<b>Pipeline Facilities by System Type from CY 2018 Annual Reports</b>			
<b>System Type</b>	<b>Kilometers</b>	<b>% Kilometers</b>	<b># Operators</b>
<b>Hazardous Liquid</b>	<b>351,302 8,231 Tanks</b>	<b>8%</b>	<b>525</b>
<b>Gas Transmission</b>	<b>485,209</b>	<b>11%</b>	<b>1,069</b>
<b>Gas Gathering</b>	<b>28,784</b>	<b>&lt; 1%</b>	<b>370</b>
<b>Gas Distribution</b>	<b>3,602,465</b>	<b>81%</b>	<b>1,355</b>

<b>Total Kilometers</b>	<b>4,467,750</b>
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<b>Liquefied Natural Gas</b>	<b>157 Plants, 230 Tanks, 87 Operators Plants - 26 Interstate and 131 Intrastate</b>
<b>Underground Natural Gas Storage</b>	<b>403 Facilities, 457 Reservoirs 17,422 Wells, 126 Operators Facilities - 222 Interstate and 181 Intrastate</b>

data as-of 7-2-2019



# Definitions

- Definitions
  - **Fugitive emissions** – methane that “leaks” unintentionally from equipment such as from pipelines, flanges, valves, or other equipment.
  - **Vented emissions** – methane that is released due to equipment design or operational/maintenance procedures, such as from pneumatic device bleeds, blowdowns, incomplete combustion, or equipment venting (e.g. relief valves).



# BLUF

- Drivers
  - PIPES Act of 2020 Sections 113 and 114
  - Executive Order on climate change
  - NTSB recommendations on leak detection
- Part of a government-wide strategy on pipeline methane emissions.
  - This rule and future rulemaking under section 114 and vented emissions.
  - Coordination with EPA, BLM, and BOEM on parallel regulatory actions.
  - Promote pipe replacement for leak prone pipe such as cast iron/bare steel pipe, ratemaking reforms, *methane detectors in homes*.
  - Self-implementing requirements of Section 114 mandate (inspection and enforcement)
  - Most significant reductions come from production, compressor stations, pipe replacement
- Parallel actions
  - Public meeting on methane emissions
  - Advisory bulletin, study, and accelerated inspection and enforcement protocols.





# BLUF

## Considerations for the Rule

- **Applicability: What transportation pipelines will be covered?**
- **Advanced Leak Detection Programs – Required Use and Sensitivity Standards**
- **Leakage Surveys – Frequency and Triggering Events**
  - **Transmission and Regulated Gathering**
  - **Distribution**
- **Minimizing Emissions from Controlled Releases (Intentional Venting)**
- **Patrols – Visual (Frequency depending on Pipeline Size, Location, and other factors)**
- **Leak Repairs – Grading of Leak Severity and Repair Timelines**
- **Maintenance of Relief Devices**
- **Odorization**
- **Reporting**



# DRIVERS

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# PIPES 2020 Section 113

Section 113 amends Section 60102 of Title 49. It requires that, in one year, the Secretary must issue final regulations requiring the following classes of operators to conduct leak detection and repair (LDAR) programs in order to “(a) meet the need for gas pipeline safety and (b) protect the environment.”

- (1) Operators of regulated gathering lines in Class 2, Class 3, or Class 4 locations; and
- (2) Operators of new and existing gas transmission pipeline facilities; and
- (3) Operators of new and existing gas distribution pipeline facilities.



# PIPES 2020 Section 113

The LDAR programs must include the following minimum performance standards reflecting the capabilities of commercially available advanced technologies that, with respect to each pipeline covered by the programs, are appropriate for:

- (1) The type of pipeline;
- (2) The location of the pipeline;
- (3) The material of which the pipeline is constructed; and
- (4) The commodities transported by the pipeline.



# PIPES 2020 Section 113

The LDAR programs **MUST** be able to “identify, locate, and categorize” **ALL** leaks that:

- (1) are hazardous to public safety or the environment; or
- (2) have the potential to become explosive or otherwise hazardous to public safety.

**In addition, the final regulations MUST:**

- (1) Require the use of advanced leak detection technologies and practices; and
- (2) Identify any scenarios where operators may use leak detection practices that depend on human senses; and
- (3) Include a schedule for repairing OR replacing each leaking pipe, except a pipe with a leak so small that it poses **NO** potential hazard, with appropriate deadlines.



# PIPES 2020 Section 114

- Section 114(a) is a self-executing provision that requires operators by 12/28/2021 to update their Operations and Maintenance Plan to:
  - 1) Address elimination of hazardous leaks and minimizing releases of natural gas from pipeline facilities.
  - 2) Consider replacement or remediation of pipelines that are know to leak based on the material, design or past operating and maintenance experience (cast iron, unprotected steel, wrought iron, and plastics with known issues)



# PIPES 2020 Section 114

- Section 114(d) requires PHMSA to conduct a study by June 28, 2022 discussing:
  - 1) The best available technologies or practices to prevent or minimize release of natural gas when making planned repairs, replacement, or maintenance.
  - 2) The best available technologies or practices to prevent or minimize release of natural gas when operator intentionally vents or releases natural gas, including blowdowns.
  - 3) Pipeline facility designs that mitigate the need to intentionally vent natural gas.
- Section 114(d) then directs PHMSA to update the Pipeline Safety Regulations accordingly.



# NTSB Most Wanted List

- **Improve Leak Detection and Mitigation** is part of NTSB's Most Wanted List.
- NTSB states that the “threat to public safety merits a comprehensive “fast-track” regulatory approach by PHMSA, and industry should implement leak-detection and mitigation measures in advance of regulation to help shape regulatory action.
- **NTSB states that Regulators should:**
  - Require all operators of natural gas transmission and distribution pipelines to equip their supervisory control and data acquisition systems with tools to assist in recognizing and pinpointing the location of leaks. (PHMSA)
  - Require the installation of automatic shutoff valves or remote-control valves in high-consequence areas and in class 3 and 4 locations. (PHMSA)
  - Require all new service regulators be installed outside occupied structures and existing interior service regulators be relocated whenever the gas service line, meter, or regulator is replaced. Multifamily structures should be prioritized over single-family dwellings. (PHMSA)
  - *Require methane-detection systems in residential occupancies with gas service. (International Code Council/ Gas Technology Institute/ NFPA)*





# PIPELINE METHANE EMISSIONS

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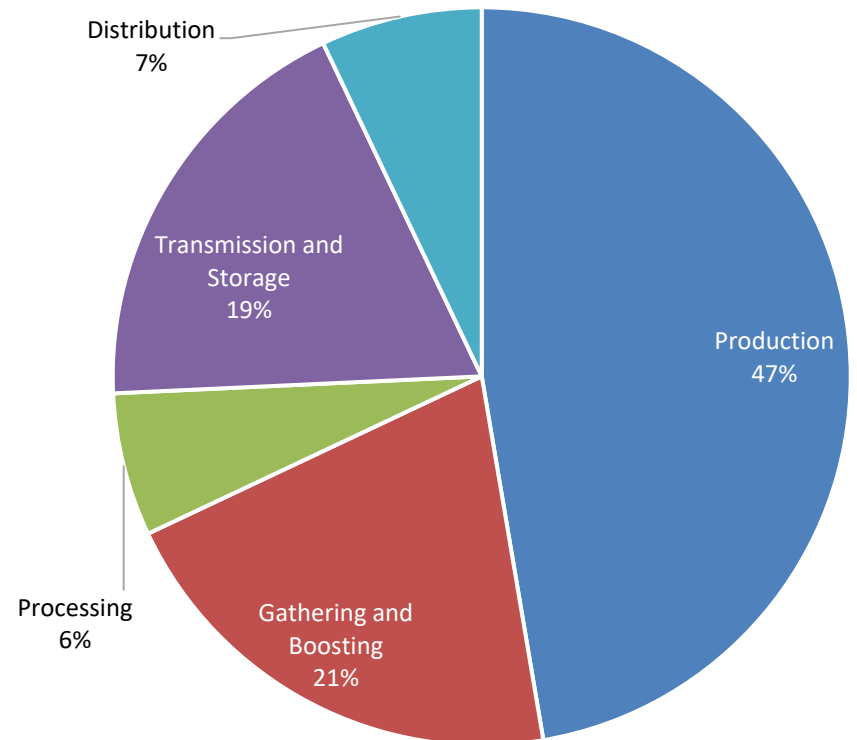
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# EPA Estimates of Methane Emissions from Oil and Gas Industry

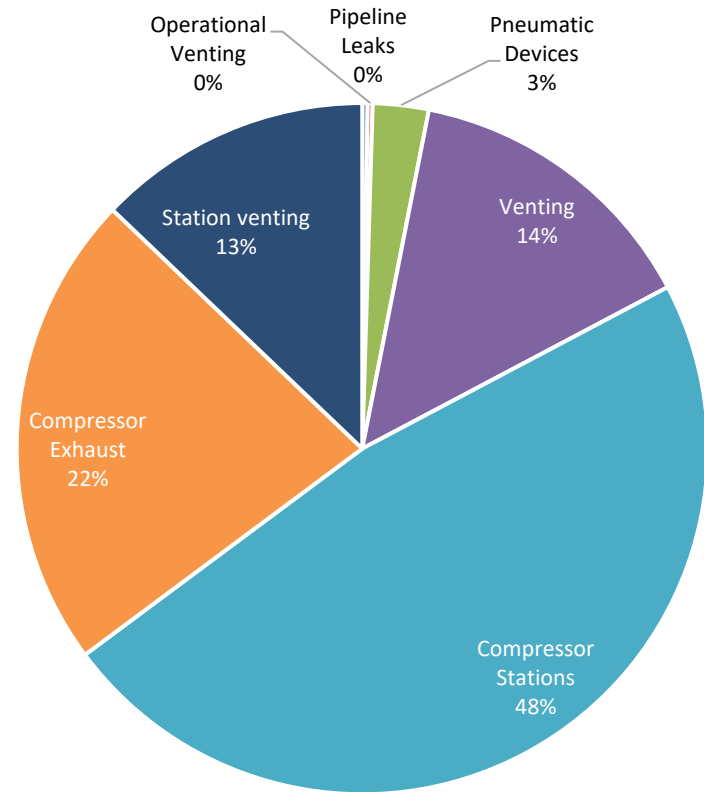
U.S. Environmental Protection Agency (EPA). Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks (GHG Inventory): 1990-2019. February 12, 2021.

Stage	Kiloton (kt) CH <sub>4</sub> in 2019
Exploration	21
Production	3,748
<b>Gathering and Boosting</b>	<b>1,636</b>
Processing Plants	497
<i>Transmission and Storage</i>	<i>1,478</i>
<i>Distribution</i>	<i>560</i>
Total	6,258



# Data – Gas Transmission

Source	Kt CH4 in 2018
Pipeline Leaks	3.3
Venting (Normal Operation)	3.0
Pneumatic Devices	34.1
Venting (Maintenance and Upset)	185.0
Compressor Station Leaks	621.2
Compressor Exhaust	291.5
Venting (stations)	167.9
Total	1,306.0

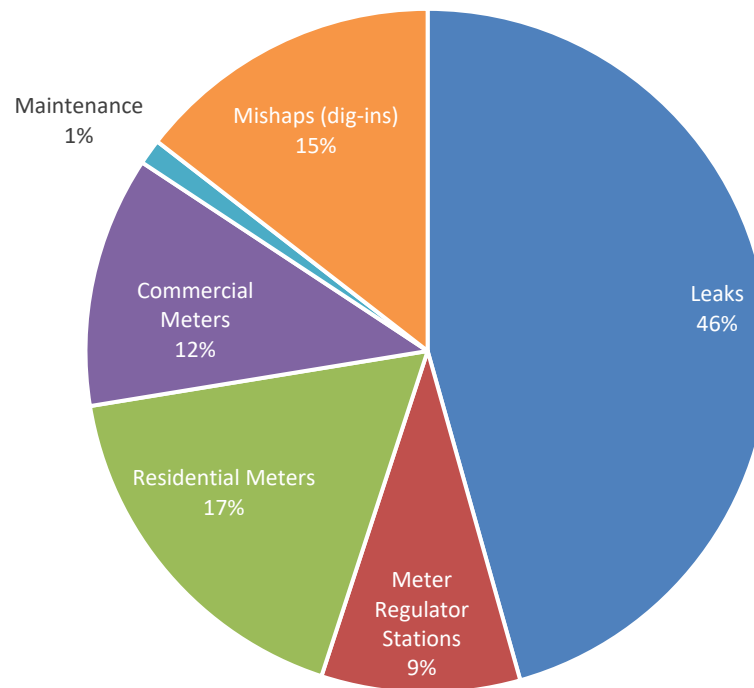


Note: 2018 emissions from the 2020 report are lower than the 2019 estimates on the previous slide, methodology tables are not yet available for the 2021.



# Data – Gas Distribution

Source	Kt CH4 in 2018
Service/Mains leaks	215.8
Meter/Regulator stations	44.4
Residential Meters	82.3
Commercial/Industrial Meters	56.1
Maintenance	5.7
Mishaps (dig-ins)	68.6
<b>Net Emissions</b>	<b>472</b>



# Fugitive Emissions - Sources

- Majority of gas distribution emissions are fugitive emissions
- Sources of fugitive emissions include:
  - Problematic pipe, especially cast iron and bare-steel systems, plastic system with known problems.
  - Commercial/industrial meter sets.
  - Compressor stations.
  - Residential meter sets.
  - Excavation damage and other incidents.



# Vented Emission - Sources

- Majority of gas transmission emissions are vented emissions.
- Sources of vented emissions include:
  - Blowdowns associated with repairs/maintenance, and replacement/construction
  - Vents from equipment such as pressure relief devices, regulators (gas use), Emergency shut down devices (ESD)
  - Ruptures and Major leaks (incidents)
  - Current facility/equipment designs.
  - The Section 114(d) study will help identify sources of vented emissions on pipeline facilities.



# Compressor Station Emissions

- Leaks, venting, and exhaust from compressor stations represent  $>4/5$  of total transmission CH<sub>4</sub> emissions.
- Compressor Emissions:
  - 57% Leaks from compressors and other equipment
  - 27% Released with exhaust
  - 16% Station venting
- EPA oversight
  - OOOOA Rule (CRA) and EPA rulemaking action to address compressor stations and other fixed facilities (e.g., gas processing plants).

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# METHANE STRATEGY: NON-REGULATOR POLICY

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# Other parts of the Strategy

## G. Safety Rules

Continue to move safety rules that have the potential to eliminate incidents. Pipeline incidents are also a major source of methane emissions.

- Example Transmission line incident:
  - 30-inch pipeline operating at 800 psig: 20 miles between block valves
  - 57 million cubic feet of natural gas with 1 hour response time
- Rulemakings to prevent and mitigate incidents:
  - Gas Transmission Final Rule (RIN2)
  - Rupture Mitigation Final Rule (Valve)
  - Gas Gathering Final Rule (RIN3)



# Other parts of the Strategy

## **A. Rate Setting**

Work with FERC and NARUC regarding rate setting and lost gas

## **B. Pipe replacement**

Work with NARUC to expedite pipe replacement (e.g., cast iron)

## **C. Excavation damage enforcement**

## **D. Methane detectors in homes**

## **E. Work with EPA and other Agencies**

## **F. Inspection/enforcement of Section 114 of the PIPES Act**

