

GAO-20-658

PHMSA Gas Pipeline Leak Data



Annual Reports: Infrastructure

Transmission and Gathering

- 1094 Transmission Operators
- 371 Gathering Operators
- Onshore transmission: 298,884 miles
- Offshore transmission: 2,854 miles
- Onshore regulated gathering: 11,324 miles
- Offshore gathering: 5,915 miles

Distribution

- 1301 annual reports
- 1.3 million miles of gas mains
- 70 million services (955,939 miles)

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PHMSA LEAK DATA

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PHMSA Leak Data

- Summary reports: [National Pipeline Performance Measures webpage](#).
- Relevant reports: Analyses over time
 - IM performance measures (includes leaks)
 - Higher-Risk Materials
 - Serious and Significant Incident Trends
- Incident and Annual Report Data Access



What we collect

Element	Gas Transmission	Gas Distribution
Incident Reports	Yes	Yes
Lost and unaccounted for gas	No	Yes
Leaks repaired by cause	Yes	Yes
Hazardous leaks repaired by cause	No	Yes
Leaks scheduled for repair	Yes	Yes
Inventory of legacy facilities	Yes	Yes
Outstanding leaks not scheduled for repair	No	No

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Annual Reports: Limitations

- No release volume data for leaks (except incidents)
- No data on leaks that are neither repaired nor scheduled for repair (e.g. grade 3 leaks).
- Transmission annual report does not include LAUF.
- Releases that are “non-hazardous that can be eliminated by lubrication, adjustment, or tightening” are not reported.
- “Intentional” releases are not included but are a significant share of emissions.

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LEAK REPAIRS

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Summary of Leak Repair Data

- Sourced from 2020 [annual reports](#).
- Gas Distribution:
 - leaks repaired
 - leaks scheduled for repair
- Gas Transmission: leaks
- Regulated Gathering (Class 2-4, offshore): leaks



Leaks—Gas Distribution

- Leaks Repaired (2020)
 - 509,763 leaks.
 - 196,317 haz. leaks.
 - 132,433 leaks scheduled for repair.
- Characteristics
 - 78% on service lines
 - Largest category: Service line equipment failure.

Cause	Total	Hazardous
Corrosion Failure	96,728	31,471
Natural Force Damage	24,318	9,014
Excavation Damage	81,834	75,329
Other Outside Force Damage	16,349	11,271
Pipe, Weld, or Joint Failure	50,275	14,082
Equipment Failure	182,928	38,516
Incorrect Operation	19,097	6,113
Other Cause	38,234	10,521
Total	509,763	196,317



Gas Distribution Leak Repairs

Total Leaks Repaired

Cause	Mains	Services
Corrosion Failure	36,800	59,928
Natural Force Damage	8,206	16,112
Excavation Damage	16,366	65,468
Other Outside Force Damage	1,230	15,119
Pipe, Weld, or Joint Failure	14,981	35,294
Equipment Failure	14,639	168,289
Incorrect Operation	3,645	15,452
Other Cause	15,253	22,981
Total	111,120	398,643

Hazardous Leaks Repaired

Cause	Mains	Services
Corrosion Failure	6,540	24,931
Natural Force Damage	2,709	6,305
Excavation Damage	14,809	60,520
Other Outside Force Damage	690	10,581
Pipe, Weld, or Joint Failure	3,647	10,435
Equipment Failure	2,694	35,822
Incorrect Operation	1,015	5,098
Other Cause	4,615	5,906
Total	36,719	159,598

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Transmission and Gathering Leaks

■ Leaks Repaired (2020)

- Transmission: 1,686
- Regulated gathering: 160

■ Leaks Scheduled

- Transmission: 378
- Gathering: 41

Cause	Transmission	Gathering
Corrosion and SCC	207	122
Manufacturing	25	6
Construction	215	0
Equipment Failure	888	9
Incorrect Operation	44	2
Excavation Damage and Vandalism	43	14
Natural/Outside Force	49	4
All Other	215	3
Total	1686	160



STATE LEAK DATA

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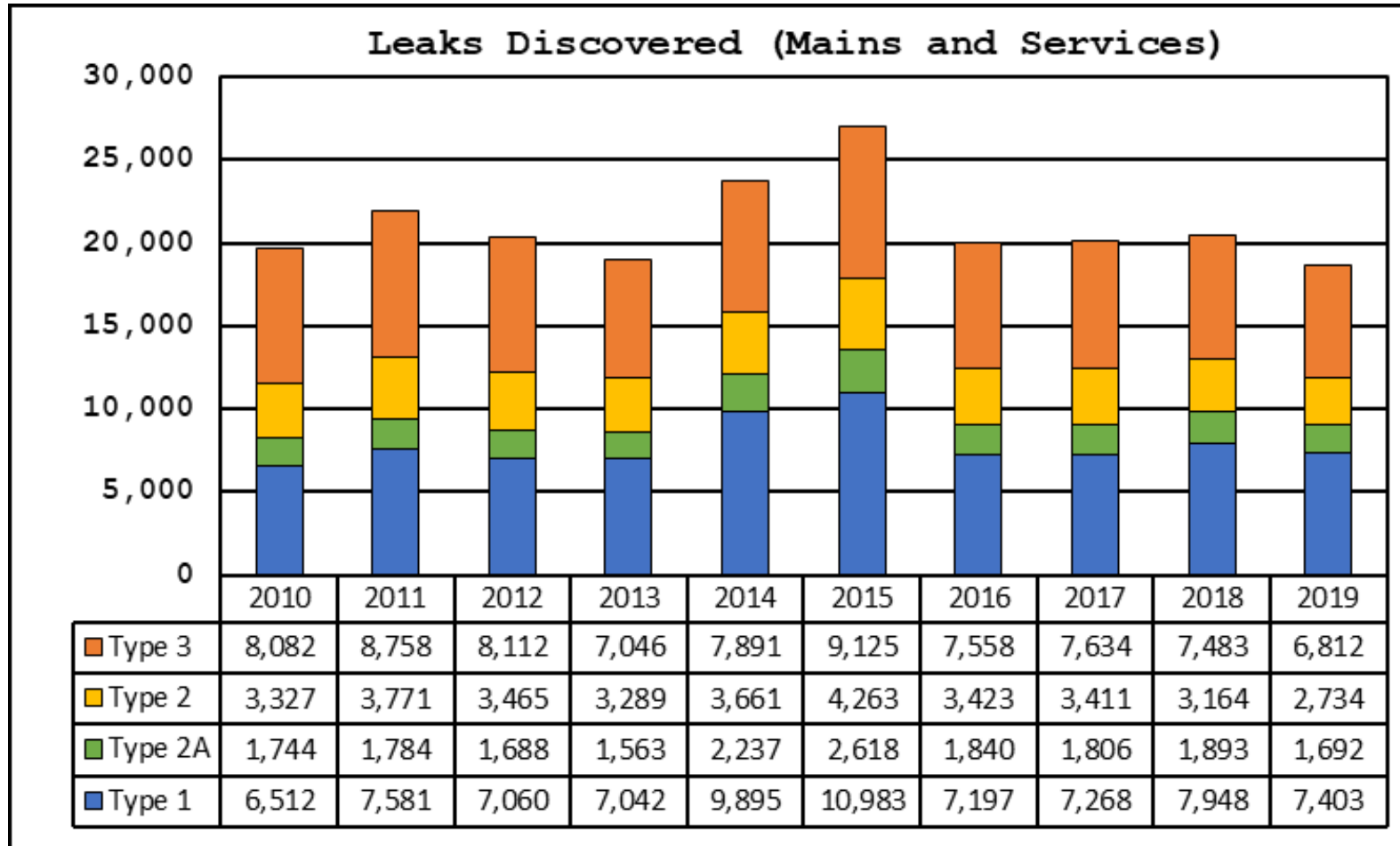
New York State Leak Data

- [New York Dept of Public Service: Annual Gas Safety Performance Measures Reports.](#)
- Discovery, repair, and year-end backlog data for regulated distribution operators.
- Type 1, 2A, 2, and 3 leaks correspond roughly to GPTC guide leak grades.
- Type 3: 37% of discovered leaks
- Type 2/2A: 24% of discovered leaks
- Leak backlogs in NY down significantly since 2003.

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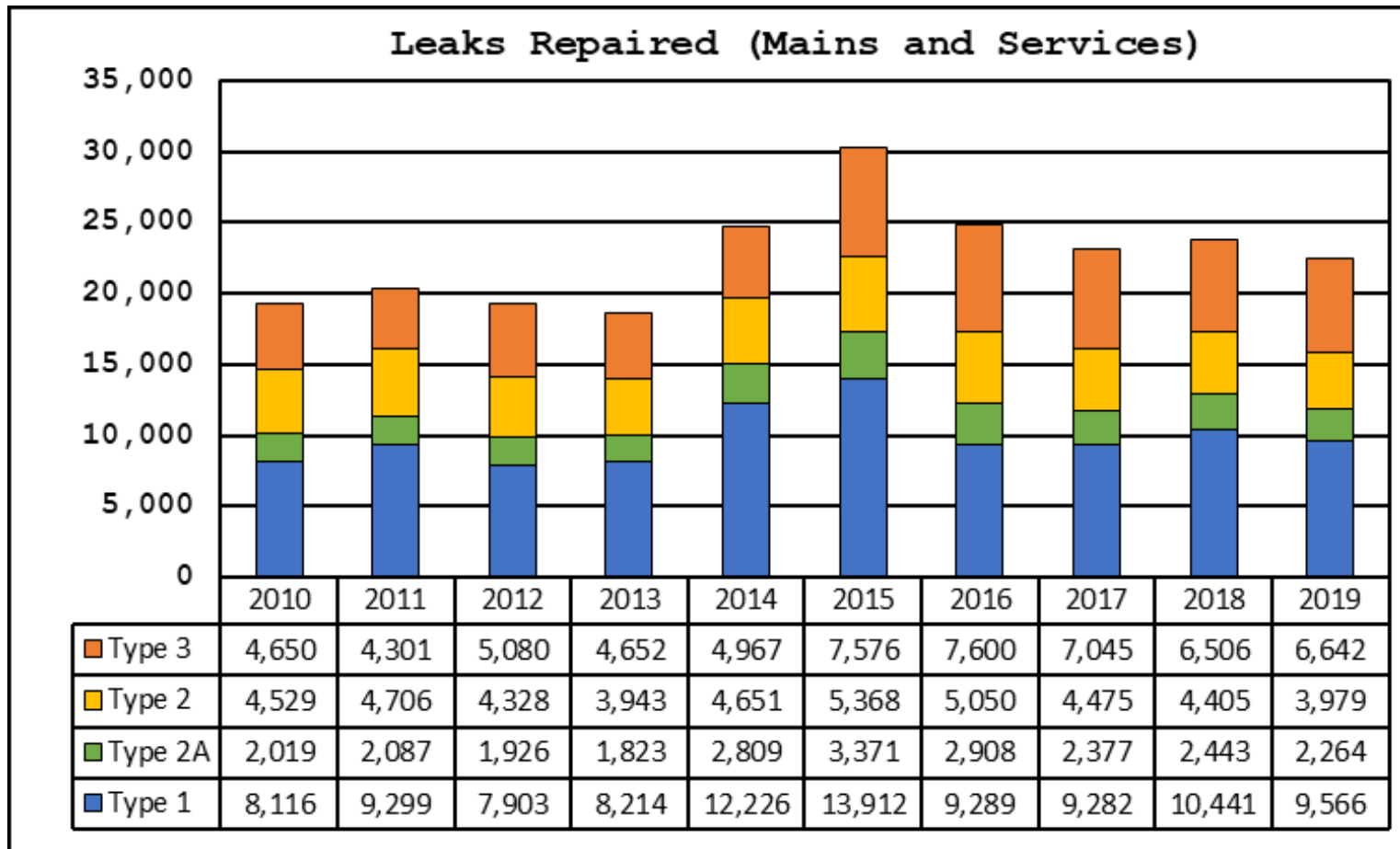
New York State Leak Data



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New York State Leak Data



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LEGACY MATERIALS

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Legacy Material Data

- Information from Annual Reports
- Pipeline Replacement Program data.
 - Cast and wrought iron inventory
 - Bare steel inventory
 - By-decade inventory
- National Pipeline Performance Measures



Legacy Materials: Distribution

- Known leak issues.
- Cast and Wrought Iron
 - 19,989 miles of mains
 - 6,981 service lines
- Bare steel
 - 40,354 miles of mains
 - 1.6 million service lines
- Pre-1970 infrastructure
 - 423,295 miles of mains (including 86,771 miles of “unknown”)
 - 15.9 million services (includes 4.5 million “unknown”)



Legacy Materials: Transmission

- Bare steel: 3,626 miles
- Pre-1970 infrastructure
 - 163,415 miles
 - 54% of mileage
 - 15% reduction since 2005

Decade	Miles
Unknown or Pre-1940	10,209
1940-1949	20,177
1950-1959	64,566
1960-1969	68,463
1970-1979	30,189
1980-1989	24,610
1990-1999	29,994
2000-2009	29,326
2010-2019	22,538



LOST AND UNACCOUNTED GAS

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Lost and Unaccounted Gas

- 2020 Distribution Annual Reports:
 - Unaccounted for gas as a percentage of total consumption.
 - 2.1% reported operator average.
 - No volume information submitted on the report form.
- [2019 EIA Gas Annual Report](#) Table A1.
 - **Lost:** 140,491 MMCF
(leaks, damage, accidents, migration, and/or blowdown)
 - **Unaccounted for:** 220,495 MMCF
(Difference between volume supply and disposition, includes losses and accounting differences)
 - LAUF percent of total consumption: 1.2%
 - Reports by state



NEXT STEPS

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Next Steps

Information on:

- How many leaks are neither repaired nor scheduled for repaired? Do other states have this information?
- Leak volume estimates: share of “super emitters”
- Location and failure mode for equipment leaks.
- Location of corrosion leaks
- Frequency and volume of intentional releases.

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Links- PHMSA

- [National Pipeline Performance Metrics](#)
- [Annual Report Data Access](#)
- Legacy Materials: also on annual reports
 - [Cast and Wrought Iron](#)
 - [Bare Steel](#)
- Regulations:
 - General repairs: § 192.703
 - Hazardous Leak Definition: § 191.1001
 - Distribution Annual Report: § 191.11;
DOT Form PHMSA F 7100.1-1.
 - Transmission Annual Report: § 191.17;
DOT Form PHMSA 7100.2.1

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Links – Outside Data

- [GHG inventory vs GHG Reporting Program](#)
- EPA GHG Inventory and Sinks:
 - [Draft 2021 GHG inventory and sinks](#)
 - [2021 GHG inventory and sinks methodology table](#)
- EPA GHG Reporting Program: [Oil and Gas Industry](#)
 - High Level: [O&G Sector Industrial Profile](#)
 - Facility Level: [FLIGHT](#)
- EDF:
 - [Blowdown Emissions and Mitigation Options](#)
 - [EDF Methane Research Series](#)
- EIA: [Gas Annual Report](#)
- New York State Safety Data:
<https://www3.dps.ny.gov/W/PSCWeb.nsf/All/9DBA66C148A1310985257B2600750639?OpenDocument>



EPA LEAK DATA

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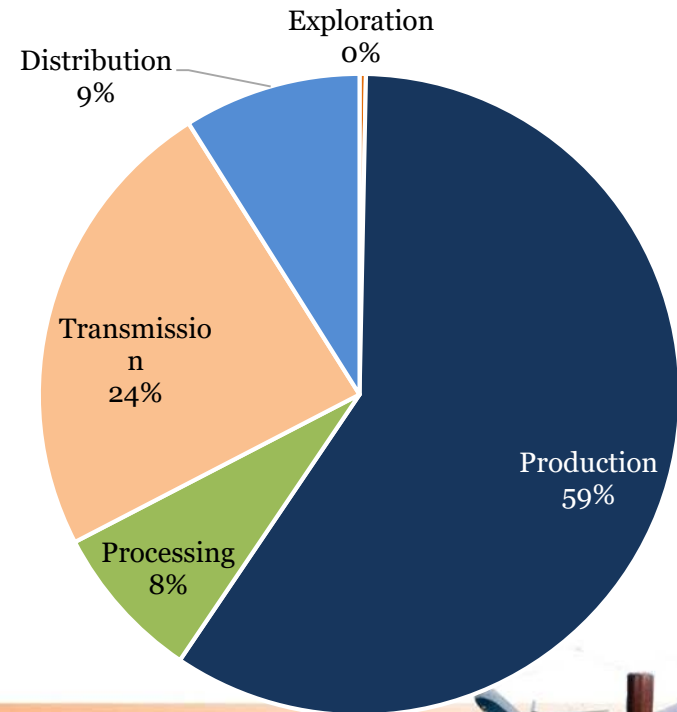


Pipeline Leaks in the National Context

2021 GHG Inventory: Sec. 3.7: Natural Gas systems, IPCC 1B2b

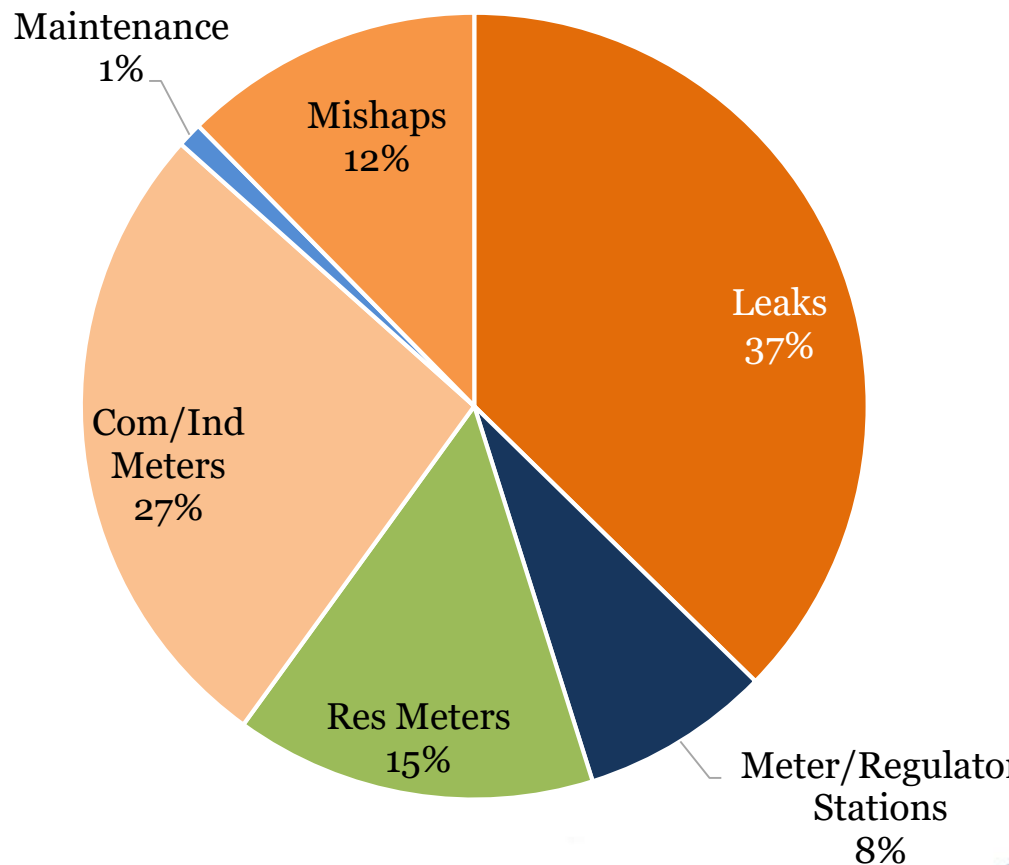
- Transmission: higher overall emissions
- Distribution: higher emissions from leaks

Stage	Kiloton (kt) CH ₄
Exploration	22
Production	3,700 (31 gathering)
Processing	497
Transmission and Storage	1,478
Distribution	560
Total	6,258



2021 GHG Inventory: Distribution

Source	Kt CH ₄ in 2019
Leaks (Mains/services)	209.0
Meter/Regulator stations	43.7
Residential Meters	83.1
Commercial/Industrial Meters	149.0
Maintenance	5.7
Mishaps (dig-ins)	69.3
Net Emissions	559.9

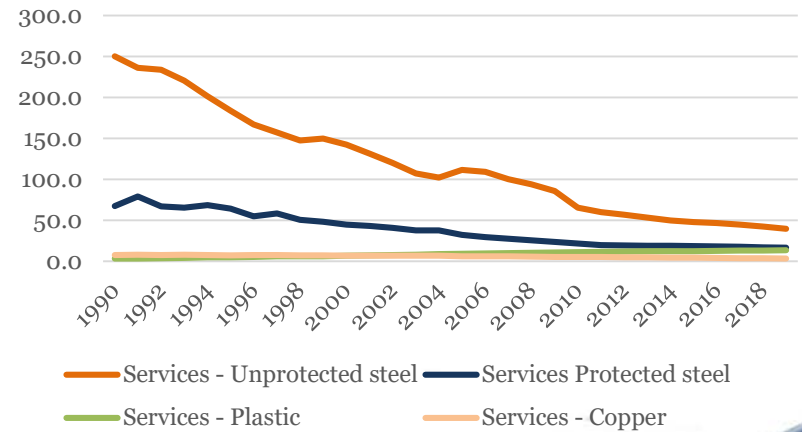
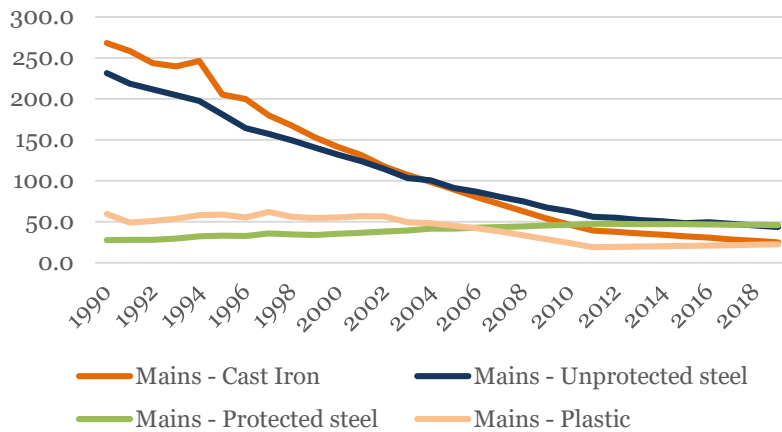


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2021 GHG Inventory: Distribution Leaks

Material	Kt CH4 from Main Leaks	Kt CH4 from Service Line Leaks
Cast Iron	24.6	N.Q.
Unprotected Steel	43.3	39.6
Protected Steel	22.3	16.6
Plastic	39.6	13.5
Copper	N.Q.	3.3

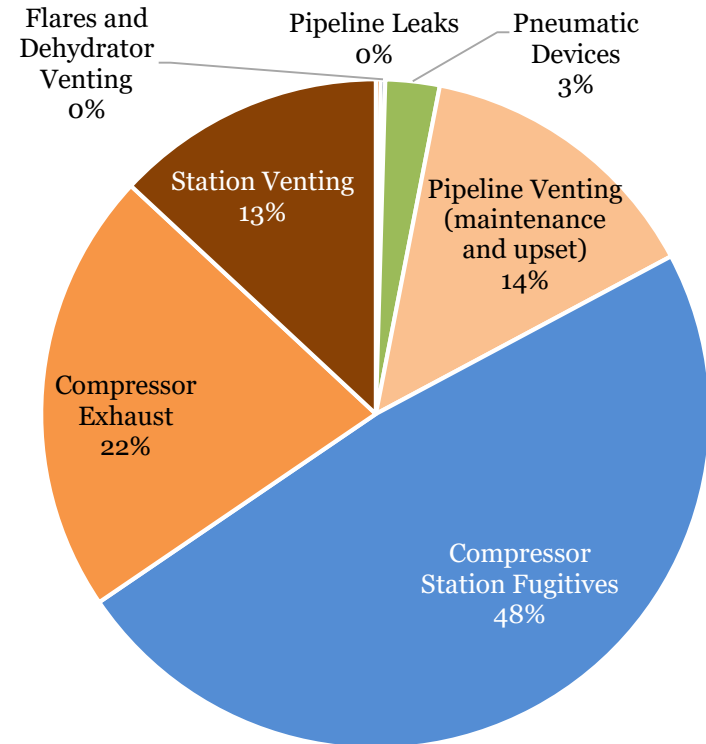


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2021 GHG Inventory: Transmission

Source	Kt CH ₄
Pipeline Leaks	3.3
Pipeline Venting (Normal Operation)	3.0
Pneumatic Devices	36.9
Venting (Maintenance and Upset)	199.4
Compressor Station Leaks	681.6
Compressor Exhaust	302.6
Station venting	184.4
Total	1,411.3



- Leaks from compressor leaks and pneumatic devices declined until 2016 but rose in 2017-2019.
- No breakdown on leak data

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2021 GHG Inventory: Compressor Stations

Source	kt CH ₄
Fugitive emissions	140.6
Reciprocating compressor	406.5
Centrifugal compressor (wet seals)	56.9
Centrifugal compressor (dry seals)	77.7
Engine Exhaust	287.0
Turbine Exhaust	1.6
Generator Engines (inc. storage)	14.0
Generator Turbine	.004
Station venting	184.4

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