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Introduction to Small Natural Gas Systems

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Module 1: Introduction and Overview

Learning Objectives

By the end of this section, you will be able to:

- **Identify** the core federal regulations and governing bodies that mandate pipeline safety standards.
- **Evaluate** the operational responsibilities of natural gas system operators regarding safety, training, and documentation.
- **Distinguish** between the functional components of transmission and distribution systems.

Executive Summary: This module establishes the regulatory framework for natural gas safety under 49 CFR Parts 190–199. It outlines the oversight roles of the DOT and state agencies, operator mandates for safety and reliability, and provides a technical overview of how gas moves from producing wells through transmission lines to the final distribution network.

Introduction

Public Law 104-304 mandates that the **U.S. Department of Transportation (DOT)** develop and enforce minimum safety regulations for the transportation of gases by pipeline. These regulations, effective since 1970, are published in **Title 49 of the Code of Federal Regulations (CFR)**, specifically:

- **Part 190:** Pipeline Safety Programs and Rulemaking Procedures.
- **Part 191:** Transportation of Natural and Other Gas by Pipeline; Annual Reports, Incident Reports, and Safety-Related Condition Reports.
- **Part 192:** Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards.
- **Part 199:** Drug and Alcohol Testing.

The **Office of Pipeline Safety (OPS)** of the Research and Special Programs Administration (RSPA) is charged with the enforcement of these standards.

Natural gas operators are legally bound by minimum safety regulations established under Public Law 104-304; non-compliance risks severe civil penalties, compliance orders, or system shutdowns via "Corrective Action Orders."

Operator Mandates and Safety Requirements

The gas pipeline safety regulations apply to both natural gas systems and operators of natural gas **master meter systems**. Under these regulations, operators must:

- **Deliver gas safely and reliably** to all customers.
- **Provide training** and written instruction for all employees.




- **Establish written procedures** to minimize hazards resulting from natural gas pipeline emergencies.
- **Maintain records** of inspection and testing (utilizing suggested forms found in Appendix B).

Personnel and State Oversight

Operators of all systems, excluding master meter systems, are required to conduct drug and alcohol testing for employees in **safety-sensitive positions** and provide an employee assistance program. These requirements are found in **49 CFR Part 199**, which incorporates the overall OPS drug testing requirements found in **49 CFR Part 40**.

State agencies may enforce these regulations under certification by the OPS. States are permitted to adopt **more stringent** safety regulations for intrastate pipeline transportation as long as they remain compatible with federal minimums.

 **Design Tip:** Professional engineers should always check with the specific state pipeline safety agency (Appendix C) to determine if state-specific requirements exceed federal regulations and to understand local inspection and enforcement procedures.

Overview

The natural gas pipeline industry is composed of **transmission** and **distribution** companies. While system complexity varies significantly, all gas pipeline companies are held to the same safety standards.

The Pipeline Lifecycle

Natural gas typically moves through the following stages:

1. **Gathering:** Flows from producing wells into gathering lines.
2. **Compression:** Moves through gathering lines and compressor stations.
3. **Processing:** Enters a processing plant where heavy ends (propane, butane, ethane, or natural gasoline) are removed.
4. **Transmission:** Travels through high-pressure transmission lines and additional compressors.
5. **Storage/Refining:** Moves to underground storage or a **Liquefied Natural Gas (LNG)** plant (liquefied at **-260 °F**), or directly to a city gate station.

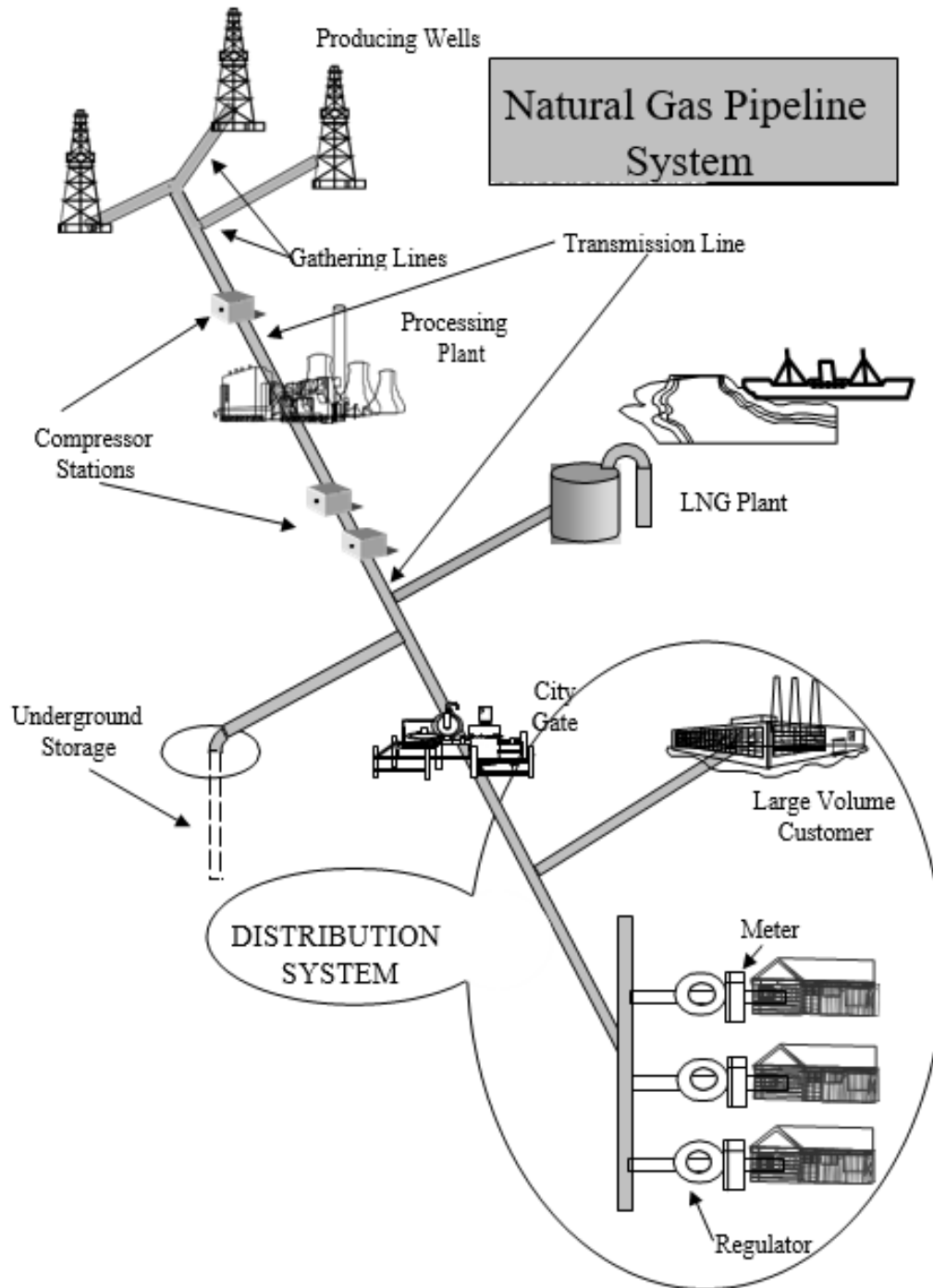


Figure I-1: Natural Gas Pipeline System

Distribution System Hierarchy

A distribution system consists of mains and services operating at varying pressures controlled by regulators.

- **Industrial Customers:** Generally receive service via high-pressure distribution mains.

- **Commercial and Residential:** Systems can be either low-pressure or high-pressure.

Natural Gas Distribution System

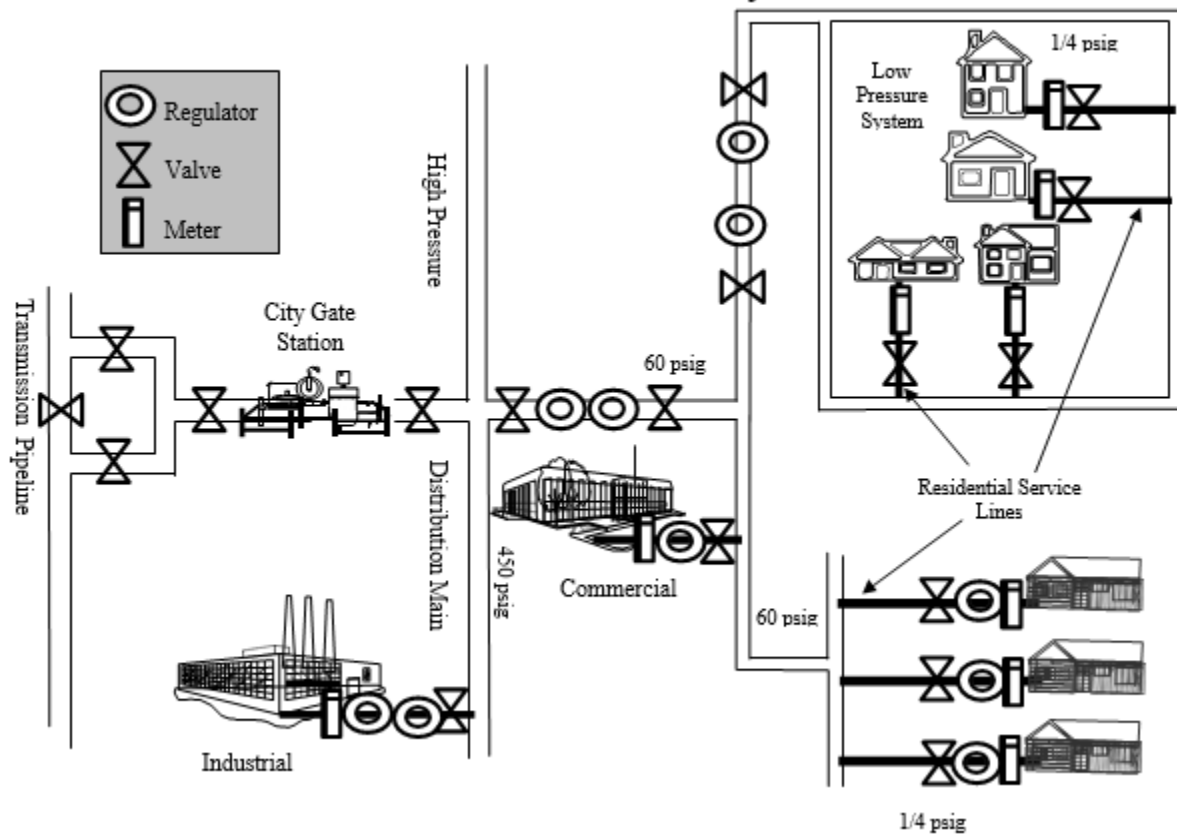


Figure I-2: Natural Gas Distribution System

Checkpoint Quiz

1. Which specific part of 49 CFR contains the "Minimum Federal Safety Standards" for the transportation of natural gas?
 - a) Part 190
 - b) Part 191
 - c) Part 192
 - d) Part 199

Answer: (c). This part specifically details the minimum safety standards for gas pipelines.



2. Under what condition can a state agency adopt safety regulations that are more stringent than federal minimums?

- a) Only for interstate pipeline systems.
- b) For intrastate pipeline transportation, provided they are compatible with federal minimums.
- c) Only if the DOT waives its jurisdiction.
- d) State agencies cannot exceed federal minimums.

Answer: (b). Certified state agencies have the authority to increase stringency for intrastate systems.

3. At what temperature is natural gas liquefied for storage or transport in an LNG plant?

- a) -100 °F
- b) -260 °F
- c) -320 °F
- d) 32 °F

Answer: (b). This is the standard physical constant for natural gas liquefaction cited in the manual.



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