



**Course length:** Two days

**Prerequisites:** None

**CPE credits:** 16

### A detailed overview of how a natural gas system works including production, transmission, storage, distribution, and operations

Reliable, safe, and cost-effective gas systems are critical to the energy upon which our society depends. Yet many in the gas business don't have a basic technical understanding of how gas systems are designed and function. Gas System Fundamentals: From Production to the Meter provides detailed insight into the components that make up a gas delivery system, how the components work, and how they are combined into functioning systems. In this seminar, participants take a guided tour of the natural gas delivery system as gas moves from production to transmission to distribution and arrives at the customer meter.



### WHO WILL BENEFIT FROM THIS SEMINAR?

- Employees working for a utility, gas marketing company, pipeline, production company, startup, or any company providing services to the gas industry
- Employees with industry experience in business areas who seek a better understanding of the physical system
- Engineers beginning their careers with natural gas utilities or pipelines
- Regulatory employees who need to understand physical system opportunities, constraints, and safety issues
- Professionals such as accountants, attorneys, finance, PR, communications, etc., who are working for an industry participant or providing services to the energy industry
- Virtually any employee with limited experience on the physical side of the natural gas industry

### WHAT PARTICIPANTS WILL LEARN

- Natural gas characteristics
- Key components of the gas delivery system and how they work
- Key design considerations for using the components in gas systems
- Key technical considerations of the gas delivery system that impact reliability, safety, and economics
- How components are used for production, processing, transmission, storage, and distribution systems
- How gas system operations maintains and operates the gas system

### COURSE AGENDA

#### Characteristics of Natural Gas

- What is natural gas?
- Key properties of gas
- Safety issues and practices

- Gas composition (raw and processed)
- Pressure
- Key definitions and units
- Energy (btu) content of gas streams
- The Ideal Gas Law
- Overview of the key components of a gas delivery system and their functions
- How the components fit together to deliver gas (production, processing, transmission, storage, and distribution)

#### Key Components of the Gas Delivery System

- Pipe
  - Stresses on pipe (internal and external)
  - Pressure classifications
  - Distribution pipe (plastic and steel)
  - Transmission pipe (steel)
  - Pipe strength and loads that cause stress
  - Specified Minimum Yield Strength (SMYS)
  - Pipeline strength and stress testing
  - Operating pressures and pressure testing
  - Maximum Allowable Operating Pressure (MAOP)
  - Pipe construction and fittings
- Compression
  - Why compression is needed and where it is used
  - Compressor capacity
  - Compressor station components
  - Station configuration
  - Types of compressors and how they work (centrifugal and reciprocal)
  - Types of prime movers and how they work (gas turbine, reciprocating engine, electric motor)
  - Support systems (station power or compressed air)





- system, fuel gas system, lube oil cooling, jacket water cooling, gas cooling towers)
- Controls (start-up and shut-down sequencing, surge controls, knock sensors, vibration detection, temperature, speed sensor)
- Emergency Shutdown System (ESD)
- Valves
  - What valves are used for
  - Types of valves and how they work (ball, plug, gate)
  - Valve service applications (station, mainline, relief, excess flow, curb, service)
  - Valve operation
  - Emergency valve designation and design
  - Class location impact on valve spacing
  - Automated valves and when they are used
- Pressure control
  - Why pressure control is needed and how it is used
  - Components that control pressure (valves and regulators)
  - Types of regulators (spring-loaded, residential, pilot-operated, monitor)
  - Regulator configurations on transmission and distribution systems
- Monitoring and control
  - Odorization and odorant systems
  - Gas quality monitoring
  - SCADA and alarming
  - Geographical information systems (GIS)
- Metering
  - How volume is converted to energy
  - Types of meters, how they work, and where they are used (diaphragm, turbine, rotary, orifice, ultrasonic)
  - Automated meter reading (AMR)
- Production and Processing System**
  - Components in production and processing systems
  - Different types of gas resources and where supply basins are located
  - Gas wells
  - Drilling and fracking gas wells
  - Gathering systems
  - Processing (at the well-head and in processing plants)
- Transmission Systems**
  - Components in the transmission system
  - U.S. transmission infrastructure
  - Pressures in various transmission systems
  - Transmission system capacity
- Storage Systems**
  - Components in storage systems
  - Types of storage
    - Storage in the pipeline system
    - Underground storage (depleted reservoirs, salt caverns, aquifers)
    - Above-ground storage (pipe-type, bottle-type, low-pressure tanks, LNG, propane-air peaking systems)
  - U.S. storage infrastructure
  - Intended use for storage and how it affects design
    - Seasonal
    - High-turn
    - Distribution system peaking
- Distribution Systems**
  - Components in distribution systems
  - Typical distribution system pressures
  - Typical distribution system infrastructure
- Gas System Operations**
  - The role of the system operator (gas control)
  - Key system factors that operations manages
  - Operations and safety
  - System maintenance
    - Planning and scheduling maintenance
    - Corrosion and pipe protection
    - Inspecting pipe (pigs and probes)
    - Post-installation pressure testing
  - Leak detection
  - Regulatory oversight of operations
  - Pipeline Integrity Management (PIM) Programs
  - Asset management plans
  - Evaluating and reducing risks
  - Emergency response
  - Gas control (day-to-day and hourly system operations)

