

“The Transportation sector of the Natural Gas business has never been covered so comprehensively in one place. This is the book that natural gas has needed for a long time. Sylvia has distilled decades of experience into an informative and readable book. This book has much to offer everyone in the business, regardless of their level of experience.”

Rusty Braziel, RBN Energy

“This is the reference book every QA person needs to be an effective natural-gas pipeline tester. I have *Trading Natural Gas* by Fletcher Sturm for my marketing clients and now I have *Contents Under Pressure* by Sylvia Munson for my pipeline and transportation clients.”

Opral Wisham, IT Quality Assurance Consultant

“This will become required reading for all Latitude employees.”

Leigh Spangler, President, Latitude Software

“This book is two books in one. It covers the basics of the gas industry for someone who wants to understand the business, and it covers in-depth workings of the industry for someone who has a good working knowledge of their area and wants to know more. I have 20+ years in the Natural Gas business, and I learned new things from this book.”

Jeff O’Block, Chorus Solutions

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**ContentsUnderPressureBook.com**

# **The Complete Handbook of Natural Gas Transportation**

# **Contents Under Pressure**

First Edition, September 2015

**Sylvia F Munson**

Farris Ventures  
Houston Atlanta Jacksonville

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**Jim Buccigross** is an experienced attorney specializing in energy, including standards, contracts, regulatory compliance, e-commerce, and related electronic transactions. He is vice president of Energy Industry Practice for Group 8760, LLC. He is the current chairman of the North American Standards Energy Board (NAESB) Executive Committee. Buccigross received a Bachelor of Science Degree from Framingham State College, an MBA Degree cum laude from Babson College, and a Juris Doctor Degree cum laude from Suffolk University Law School. He is admitted to the bar in Massachusetts, the District of Columbia, and various federal districts.



**Kathryn Burch** worked for Spectra Energy Corp in a variety of departments, starting as an analyst in Gas Control, then customer services, measurement, marketing, the LINK Group, and finally in Regulatory Affairs. She served as Spectra Energy's representative on the Executive Committee for the North American Energy Standards Board, and was influential in the development of key business standards for the interstate gas pipeline industry.

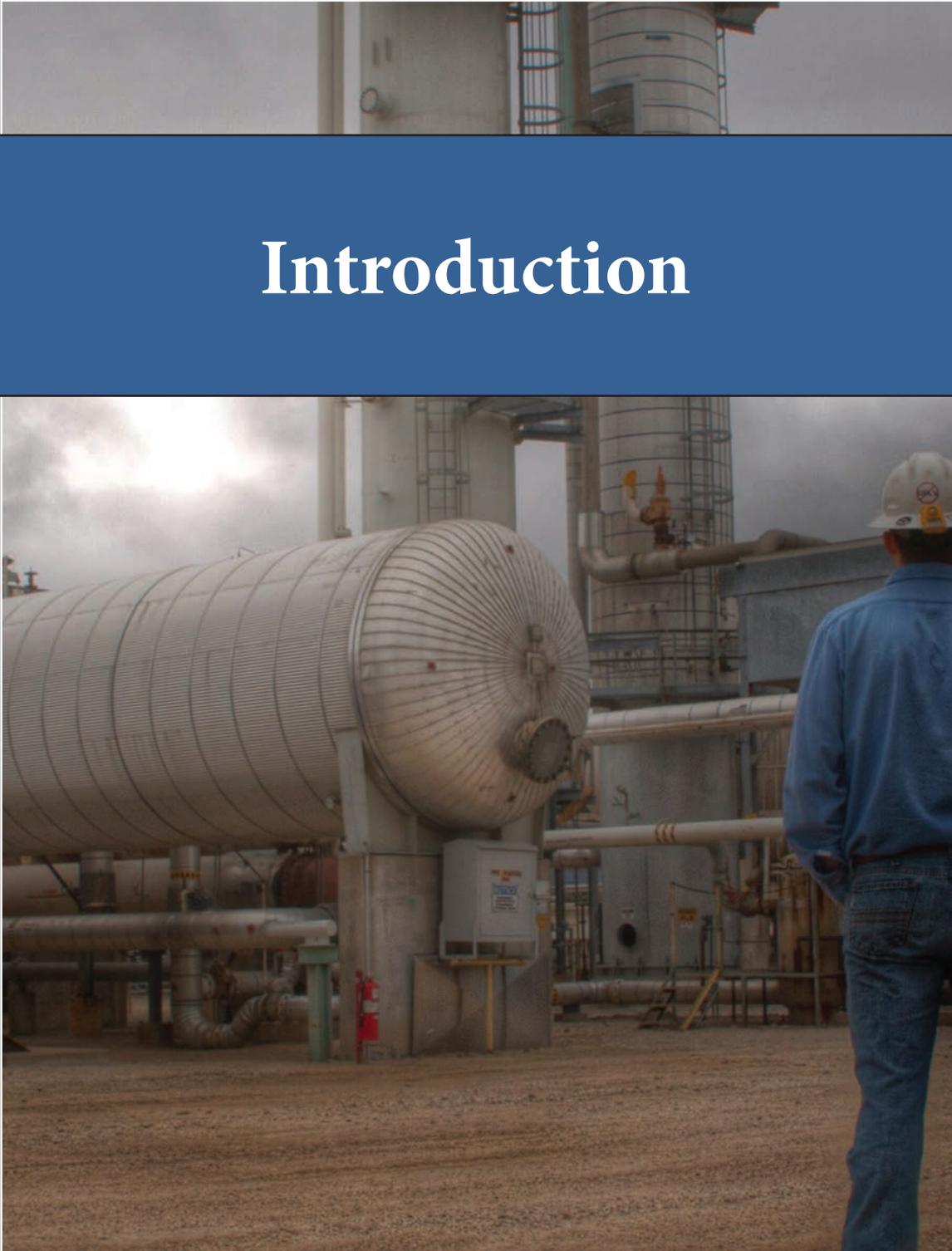


**Jeff O'Block** has worked as a software engineer in the energy industry for more than 25 years. O'Block was the original architect and developer for Panhandle Eastern, Trunkline, and Texas Eastern's customer systems. He was also the original developer of GMS and GTMS, and Altra and Sungard's natural gas accounting and management systems. He is currently president of Chorus Solutions, a custom software development company for the energy industry



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\*The views and opinions expressed in this article are those of the author and do not necessarily reflect the official policy or position of National Fuel Gas Distribution Corporation.

A photograph of an industrial facility, likely a refinery or chemical plant. In the foreground, a worker wearing a blue long-sleeved shirt, blue jeans, and a white hard hat with a logo is seen from the back, looking towards the equipment. The central focus is a large, horizontal, cylindrical tank with a ribbed or corrugated surface, supported by a metal frame. To the right, there are more industrial structures, including a vertical cylindrical tank and various pipes and valves. The ground is a mix of dirt and gravel. The sky is overcast and grey. A blue rectangular banner with the word "Introduction" in white serif font is overlaid on the top half of the image.

# Introduction

## I. WHY THIS BOOK

In my career, I have had the opportunity to teach many people – mainly IT people – about the natural gas business. It amazes me how many people work in various business groups in our industry and do what they are told by someone without truly understanding the nature of the business they are supporting. Others have worked in their specific areas of the business for several years, but do not have an understanding of the processes of the business as a whole. Understanding the business allows everyone to ask the right questions and to interpret the gaps in information in a much more successful manner.

In the last 19 years of my career, since the Federal Energy Regulatory Commission (FERC) first adopted the standards of the North American Energy Standards Board (NAESB) (aka Gas Industry Standards Board (GISB)) as operational standards for the interstate gas industry, I have had the opportunity to teach many people about the standards. I have found that, in many cases, an understanding of the North American natural gas business must be taught first, so that the NAESB standards make sense.

This book comes from the heart. I love to teach. I love the natural gas industry. I find it a very interesting industry to be a part of because it incorporates so many different types of people and processes. There's the chemistry side of things - natural gas is methane or CH<sub>4</sub>, plus a host of secondary components. There's the engineering side with pipelines and flow-control valves. There's the geology side with exploration and drilling. There's the financial side with trading and risk and hedging. My list could go on and on. But really, the gas industry consists of a lot of real people who are trying to make sure that they keep your house warm in the winter and your gas grill working well in the summer. Good people doing a great job.

I based this book on the North American gas business - primarily the business in the United States. It focuses on the transactions and interactions required to transport gas from its point of origin to the burner on your heater or grill. Getting the gas from the well to your burner may require many transactions, many different business parties, and must comply with many regulations in the lifecycle of that gas flow.

One of the fun aspects of the natural gas business is that it is always changing. Technology changes in exploration, production, and transportation create new opportunities, cause market shifts, and cause companies to create new services to utilize those shifts. Additionally, the computer-technology changes that are constantly added to the market place create opportunities to see the business in a different way. On top of that, the Federal rules governing the business change, and the NAESB rules to implement the

business change. This keeps the industry constantly shifting. It makes being a part of this industry fun. Change is good and a great opportunity to learn.

## **II. WHO IS THE AUDIENCE?**

Who is this book for? This book is for anyone who wants to understand the transportation of natural gas. It is for business people who work in a specific area of the gas business and want to understand what their counterparts do. It is for support staff, such as legal and IT people, who want to understand the business that is being conducted in the areas they support. It is for experts in the industry who may want to round out their knowledge. It is for anyone.

## **III. ABOUT ME**

I have been working in the natural gas industry for more than 30 years. My background is in chemistry and computer science. My primary role these past 30 years has been as a consultant helping companies implement technology solutions for natural gas while meeting the requirements of regulatory compliance. I have had the privilege of working in production, gathering, midstream, intrastate, interstate, and local distribution companies, but have not worked for an end-user/consumer (yet) even though I, myself, am a consumer of natural gas. During this time, I have worked in IT, Regulatory Affairs, Marketing, Sales and, my favorite, Training. I have had the opportunity to contribute writing to several energy publications and to be interviewed by several energy-trade publications during this time.

I have also participated in NAESB since its inception, serving as the chair of multiple subcommittees, teaching standards classes, serving on the Board of Directors and Executive Committee, and writing standards; I have also been employed by NAESB for a time.

The most important things to know about me are that I love to learn, I love the gas industry, and I am proud to be a part of the work that I have done. But what you really want to know is that I love my two daughters and two grandchildren. I prefer dogs over cats, chocolate over vanilla, and I love my God and country.

## **IV. ORIGIN OF MATERIALS**

The information in this book comes from many years of working in this industry in all of its different segments. This book will give you a thorough understanding of the gas

transportation business. The primary sources of reference will be FERC regulations and the NAESB standards and implementation guides. You will need the NAESB standards and implementation guides as additional information if you are implementing a business process that needs to be compliant with regulations.

The NAESB standards, along with the Code of Federal Regulations related to Natural Gas Transportation, comprise the governing rules for conducting business in natural gas transportation. These standards set the boundaries within which the industry works. The standards are primarily focused on the pipelines that transport gas, but they impact all industry participants because, to get the gas from point A to point B, it must go through a pipeline. To transport gas through a pipeline requires the owner of the gas and a contract. It may also involve purchases, sales, agents, etc.

Additionally, that pipeline may be a gathering system, a state-level pipeline, an intrastate, an interstate, a 311 pipeline, a Hinshaw pipeline, a local distribution company, or a utility. Generally, to get gas from point A to point B, at least two of these types of pipelines must be involved. In many cases, a single transportation plan may involve all of the pipeline types listed above. There are always exceptions. Always. For this book, we will refer to interstate pipelines as interstates and all other pipelines as non-interstates.

In addition to my own experience and knowledge, I have asked experts in the industry to contribute their stories, relevant to certain sections of the book. These experts come from many different types of companies within the gas industry and have graciously contributed their experiences to make the book's information relevant to the reader.

Caveat: This book references the NAESB standards. However,

1. It is not intended to replace the NAESB standards nor to interpret them.
2. There are many implementations of the standards that will not be addressed in this book.

The NAESB standards provide specific rules that must be incorporated into an overall business process, but do not define the business process that must be accomplished. The standards establish a set of boundaries within which to operate, but they do not always dictate a specific solution. Therefore, there will be many implementations of the standards that appear to be very different but are within the boundaries of the standards. This is a very important concept to understand. A clear reading of the NAESB standards is essential before attempting to use them. This book is intended to aid the reader/implementer in understanding the variances and opportunities in the business process,



# Foundation Information



Before diving into the overall business and processes, it is good to have a basic understanding of what natural gas is, where it comes from, and how natural gas transportation fits into the overall natural gas industry. There are many participants in natural gas such as exploration, drilling, production, processing, distribution, and utility management. The transportation sector is a key component because it moves the gas from the source to the destination, but there are other relationships worth understanding. In addition, natural gas and transportation are highly regulated. It is good to introduce those parties at the federal, state, and local level.

## 1. HIGH-LEVEL PICTURE OF THE NATURAL GAS INDUSTRY

### What is natural gas?

Let's start at the beginning – natural gas consists of methane – CH<sub>4</sub>. It's as simple as that? NO! When gas comes out of the ground, it may have many other components in it, but the goal is to have as pure methane as possible when transporting and burning natural gas. What's it really made of?

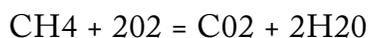
Natural gas is by nature a random grouping of chemicals. Natural gas coming out of the ground may have heavier carbon gases with it as high as octane. The content of the gas will vary by where the gas is coming from. The heavier the hydrocarbon in the gas, the less of that gas there will be. Additionally, it may contain water, sulfur, and other impurities. Gas that contains sulfur is described as sour. All of these extra components may affect the heating value of the gas. Gas with too many additional components will be sent through a processing plant to remove them. The gas going into the plant is considered “wet” gas, and the pure-methane gas that comes out of the plant is referred to as “dry” gas.

The heating value of the gas is measured in British Thermal Units (BTUs). Volume of gas is measured in thousand-cubic-feet (MCF), million-cubic-feet (MMCF), or billion-cubic-feet (BCF) units. Gas that has been converted to a quantity of heating value is referred to in Dekatherms (DTH). U.S. transportation contracts most commonly use the DTH measurement of gas.

Name	Number of Carbon Atoms	Molecular Formula	Structure	Word Root
Methane	1	CH <sub>4</sub>	CH <sub>4</sub>	Meth
Ethane	2	C <sub>2</sub> H <sub>6</sub>	CH <sub>3</sub> -CH <sub>3</sub>	Eth
Propane	3	C <sub>3</sub> H <sub>8</sub>	CH <sub>3</sub> -CH <sub>2</sub> -CH <sub>3</sub>	Prop
Butane	4	C <sub>4</sub> H <sub>10</sub>	CH <sub>3</sub> -(CH <sub>2</sub> ) <sub>2</sub> -CH <sub>3</sub>	But
Iso-Butane	4	C <sub>4</sub> H <sub>10</sub>	CH <sub>1</sub> -(CH <sub>3</sub> ) <sub>3</sub>	But
Pentane	5	C <sub>5</sub> H <sub>12</sub>	CH <sub>3</sub> -(CH <sub>2</sub> ) <sub>3</sub> -CH <sub>3</sub>	Pent
Iso-Pentane	5	C <sub>5</sub> H <sub>12</sub>	CH <sub>2</sub> -CH-(CH <sub>3</sub> ) <sub>3</sub>	Pent
Hexane	6	C <sub>6</sub> H <sub>14</sub>	CH <sub>3</sub> -(CH <sub>2</sub> ) <sub>4</sub> -CH <sub>3</sub>	Hex
Heptane	7	C <sub>7</sub> H <sub>16</sub>	CH <sub>3</sub> -(CH <sub>2</sub> ) <sub>5</sub> -CH <sub>3</sub>	Hept
Octane	8	C <sub>8</sub> H <sub>18</sub>	CH <sub>3</sub> -(CH <sub>2</sub> ) <sub>6</sub> -CH <sub>3</sub>	Oct
Nonane	9	C <sub>9</sub> H <sub>20</sub>	CH <sub>3</sub> -(CH <sub>2</sub> ) <sub>7</sub> -CH <sub>3</sub>	Non
Decane	10	C <sub>10</sub> H <sub>22</sub>	CH <sub>3</sub> -(CH <sub>2</sub> ) <sub>8</sub> -CH <sub>3</sub>	Dec

*Table 1.1*  
*Molecular Formulas*

The larger the molecule, the more energy is released when the molecule is burned. Burning is simply combining the hydrocarbon with oxygen. The reaction for methane is as follows:



So, one methane molecule combines with two oxygen molecules to form one carbon dioxide molecule and two water molecules. This is why natural gas is called “clean”, as the by-products of combustion are water and plant loving CO<sub>2</sub>.

Molecules C<sub>6</sub> and greater are often liquids. The state of each molecule is determined by its saturation as well as the temperature and pressure of the gas. Note the bigger the molecule, the more high dollar value it has. The term “plant processing” is used to define the process of separating out these molecules from the “natural gas.”

## The natural gas industry

The natural gas industry spans a wide range of activities and responsibilities. From the geologist who explores potential gas reserves to the utility-company employee turning the gas on at a house, there are many different roles to get the gas from the ground to the consumer.

The exploration and production area of natural gas is where the gas is discovered; the wells are drilled; and the gas is brought up from the ground, cleaned through plant processing, and made ready for transportation. Producers, well operators, gatherers, midstream transporters, and plant operators manage these processes. This area of the business is also referred to as gas gathering.



*Figure 1.1*  
Gas industry participants in relative order of the flow of gas

The transportation side of the industry takes the gas from the wellhead or other point of readiness in the production system to the burner tip or last point of delivery on the transportation system. The pipelines, transporters, and storage operators who conduct business in the interstate and non-interstate marketplace manage this part of the business. Non-interstate transportation may occur on intrastate pipelines, midstream systems, or local distribution companies that transport gas for others.

The distribution side of the industry takes the gas from the transportation pipeline, a local

# Endnotes



## ENDNOTES

1. [www.ferc.gov](http://www.ferc.gov)
2. [www.naesb.org](http://www.naesb.org)
3. The best available quantity is a transaction based quantity determined by the best-of the actual allocated quantity, estimated allocated quantity, scheduled quantity, confirmed quantity and nominated quantity.
4. NAESB WGQ Version 3.0 Standards, North American Energy Standards Board, November 14, 2014. <https://naesb.org/wgq/imp.asp> (This document is password protected). Book 1 – Nominations; Standard 1.4.1 Dictionary
5. See 18 CFR 284.8(h)(3), or FERC Order No 712, June 19, 2008; [http://www.ecfr.gov/cgi-bin/text-idx?SID=3538e80d439a8f5930ba738494aa0287&node=se18.1.284\\_18&rgn=div8](http://www.ecfr.gov/cgi-bin/text-idx?SID=3538e80d439a8f5930ba738494aa0287&node=se18.1.284_18&rgn=div8)
6. aka Retail Access: 18 CFR 284.8(h)(4), or FERC Order No 712, June 19, 2008; [http://www.ecfr.gov/cgi-bin/text-idx?SID=3538e80d439a8f5930ba738494aa0287&node=se18.1.284\\_18&rgn=div8](http://www.ecfr.gov/cgi-bin/text-idx?SID=3538e80d439a8f5930ba738494aa0287&node=se18.1.284_18&rgn=div8)
7. NAESB WGQ Version 3.0 Standards, North American Energy Standards Board, November 14, 2014. <https://naesb.org/wgq/imp.asp> (This document is password protected). Book 1 – Nominations; Standards related to pooling: 1.2.3, 1.3.17, 1.3.18
8. NAESB WGQ Version 3.0 Standards, North American Energy Standards Board, November 14, 2014. <https://naesb.org/wgq/imp.asp> (This document is password protected). Book 0 – Additional Standards, Standards related to contract parties: 0.3.1, 0.3.2, 0.3.28; Book 1 - Nominations, Standards related to contract parties: 1.3.75
9. CFR 184.18, FERC Order No 712, June 19, 2008
10. NAESB WGQ Version 3.0 Standards, North American Energy Standards Board, November 14, 2014. <https://naesb.org/wgq/imp.asp> (This document is password protected). Book 0 – Additional Standards, Standards related to contract locations: 0.3.23, 0.3.24, 0.3.25, 0.3.26, 0.3.27, 0.3.29, 0.4.4
11. Some pipeline tariffs refer to the location-level MDQ as MDRQ for Maximum Daily Receipt Quantity and MDDQ for Maximum Daily Delivery Quantity.
12. Note that a path level MDQ is only relevant if the nomination model type for the contract is wither pathed or pathed non-threaded. A path level MDQ would not apply to a non-pathed model type.
13. NAESB WGQ Version 3.0 Standards, North American Energy Standards Board, November 14, 2014. <https://naesb.org/wgq/imp.asp> (This document is password protected). Book 1 – Nominations Related Standards, Contracts charges related standards 1.1.16

**GLOSSARY**

**311 pipeline:** Intrastate pipeline subject to section 311(a)(1) of the Natural Gas Policy Act that requires it to file rates and charges and a tariff or Statement of Operating Conditions with FERC. Includes all intrastate pipelines that transport gas on behalf of other intrastate or local distribution pipelines served by an interstate pipeline.

**ACA:** Acronym for “Annual Cost Adjustment.” For definition, see “Annual Cost Adjustment.”

**Accounting party:** Receives invoices and accompanying reports for transportation contract. May be shipper, agent, or other party designated in contract.

**Additional Standards:** One of a series of nine NAESB Wholesale Gas Quadrant books in which NAESB standards are codified; contains standards that apply generally to other books of NAESB standards and contains standards that do not fit into other categories.

**Agent:** Through a contractual relationship with pipeline and shipper or operator, acts as a representative to conduct business on behalf of shipper or operator.

**Aggregate:** When shippers combine various packages of gas into one larger amount.

**Allocations:** Process whereby the pipeline reconciles the gas that was scheduled to flow with the actual flow of gas on the pipeline and allots to its customers the portion of the gas for which they contracted.

**Annual Cost Adjustment:** Fee charge by interstate pipeline. Also known by acronym “ACA.”

**Asset manager:** Entity in special relationship between shipper and agent with enhanced rights to transport its own or its customer’s gas without violating the “Shipper must have title rule.”

**Associated contract:** Designates a contract other than shipper’s transportation contract that is important to a transaction, such as a storage contract.

**Auto-confirmation:** Agreement between two interconnected parties in which any nomination entered for a location is automatically assumed to be confirmed to enable the pipeline to proceed with scheduling process.

**Balancing service:** Method used to keep shipper in balance at all times between the amount it delivers onto the pipeline and the amount it receives off the pipeline. Pipelines may have specific contracts or may use storage contracts for this purpose.

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