# AGA Report No. 4A

## Natural Gas Contract Measurement and Quality Clauses

Sponsored by Transmission Measurement Committee

AGA
American Gas Association

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**Transmission Measurement Committee**




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# FOREWORD

The history of natural gas supply, transportation and utilization in the United States has been marked by several cycles of change related to increased demand for fuel gases and development of new and diverse gas sources. Gas quality considerations figure prominently in the adaptability of the industry to such changes since the variability of natural gas and its associated constituents affects all industry sectors from wellhead to burner tip. In addition, regulatory drivers associated with the evolution of open access to and unbundling of pipelines resulted in the need for enhanced gas quality and measurement specifications contained within pipeline tariffs. This document results from the collaborative efforts of a team of industry experts and represents the most up-to-date compilation of gas quality and measurement considerations for inclusion in gas contracts and pipeline tariffs.

Prior to 1945 most of the fuel gases throughout North America were produced locally or manufactured from coal specifically for a given geographic area. Over the next several decades, new sources of natural gas were discovered, and a vast network of interstate/intrastate pipelines, currently known as the “pipeline grid,” was constructed to deliver new supplies to the marketplace. As the pipeline grid expanded to criss-cross the North American continent, most local gas manufacturing ceased, and the demand for natural gas delivered by interstate/intrastate pipelines increased dramatically. The gas from new sources of supplies with varying composition did not affect the gas transmission and distribution systems. However, the composition of the new gas supplies had the potential to adversely affect the utilization of the gas. To avoid this adverse effect at the burner tip, research programs were undertaken to develop equations/indices to determine the interchangeability of various gas compositions.

During the later decades of the 20th century, variability of supply sources and associated gas compositions continued to increase resulting in widespread industry recognition of the need for gas quality evaluation criteria. Some industry sectors proposed standardization of gas quality and imposition of specific constituent limits as well as composition-dependent parameters, such as heating value, interchangeability indices, etc. However, the broader industry consensus was that such constraints would be overly restrictive and would exclude supplies that could otherwise be made interchangeable by pipeline aggregation and consequential blending upstream of market deliveries. The first version of AGA Report 4A was published in 1971 to identify specific criteria for contracts or tariffs related to custody transfer measurement and gas quality specifications.

Beginning in the 1980s and culminating with the Federal Energy Regulatory Commission (FERC) Order No. 636, the interstate pipeline grid transitioned from an operational model in which gas pipelines were merchants, with the pipelines contracting for gas supplies with producers and reselling the gas downstream pursuant to regulated tariffs. Under the new model, interstate pipelines became open-access transporters of natural gas that is owned by third parties. This transition is commonly referred to as the *restructuring of the gas industry*. Also, under this new model, gas supply contracts between producers and interstate pipelines were eliminated and replaced by gas supply contracts between producers and wholesalers or end users, often referred to as “unbundling” of the pipelines. As a result of increased gas supply options for wholesalers and end users, variations in natural gas compositions on pipelines increased and the pipeline grid became more interconnected. The enhanced integrated nature of the pipelines coupled with a wider variety of supplies entering the system via open access raised the importance of considering gas quality specifications within pipeline tariffs.

Gas supply compositions were relatively stable within the major interstate pipelines and larger US markets through the 1980s and early 1990s, even though gas quality differed from region to region. During that time, gas quality management issues were largely limited to those local distribution companies (LDCs) that were located in areas with variable gas sources, such as local production and processing, refinery, imported liquefied natural gas (LNG) and various other local sources. Gas quality issues again confronted the US gas industry at the national level when demand increased in the 1990s and 2000s due to a convergence of factors, including the environmental advantages of natural gas-fired electricity generation and other end-use applications. North America was faced with the challenge of satisfying higher demand with greater volumes from non-traditional gas sources, such as coal bed methane, LNG imports, renewable gases, etc.

In 2004, the Natural Gas Council (NGC) convened two teams of technical experts from across the natural gas value chain, referred to as NGC+, to address gas quality issues related to gas interchangeability and hydrocarbon liquid drop out in pipeline systems. Each technical group published its findings and recommendations in a white paper that was presented to FERC in February 2005[1]. The "White Paper on Natural Gas Interchangeability and Non-Combustion End Use" included interim guidelines for gas interchangeability that were derived primarily from the interchangeability index calculations for gas appliances and from the constituent limits of modern gas turbine power-generation equipment. The white paper also included recommendations for additional research to resolve outstanding technical issues.

In June 2006, FERC issued a policy statement[2] that supported the collaborative technical review conducted under the NGC+ that outlined five basic principles for interstate pipelines and their customers when considering gas quality specifications:

- **Only natural gas quality specifications contained in a FERC-approved tariff can be enforced.**
- **Specifications must be flexible and allow pipelines to balance safety and maximize supply.**
- **Specifications must be based on science, and negotiations must involve all interested parties.**
- **The NGC+ Interim Guidelines should serve as a common technical reference point for resolving issues.**
- **Disputes will be resolved in FERC proceedings with significant weight given to the NGC+ Interim Guidelines.**

An industry team was assembled in 2006 to review and revise AGA Report 4A. The current document has been updated considering the NGC+ white papers and the FERC Policy Statement[2], as well as other recent industry developments, such as the US Department of Transportation's (DOT) pipeline integrity management regulations and industry advances in measurement technologies.

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[1] White Paper on Liquid Hydrocarbon Drop Out in Natural Gas Infrastructure, NGC+ Liquid Hydrocarbon Drop Out Task Group and White Paper on Natural Gas Interchangeability and Non-Combustion End Use, NGC+ Interchangeability Work Group, February 28, 2005.

[2] Specific information and industry comments regarding the FERC Policy Statement may be found on the FERC web site in Docket No. PL04-03 at www.ferc.gov.

# ACKNOWLEDGEMENTS

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Individuals who made considerable contributions to the revision of this document and are also being especially acknowledged:

| | |
|---|---|
| Ben-Poorat, Shaaban | Laclede Gas Company |
| Bender, Carl F. | National Fuel Gas Supply Corp. |
| Boschee, Rod | Pacific Gas and Electric Company |
| Bowles, Ed | Southwest Research Institute |
| Bronner, Joe W. | Pacific Gas and Electric Company |
| Busch, Jim | BP Energy |
| Cathey, Mike | Shell North America LNG |
| Chester, Craig E. | Williams Gas Pipeline |
| Dishong, Duane R. | Equitable Gas |
| Drenker, Jeff | Questar Gas Company |
| Drogalis, Amy | National Grid |
| Floyd, Angela | ConocoPhillips |
| Ford, Peter | Public Service Co. of New Mexico |
| Grimard, Wraye | TECO Peoples Gas |
| Gustilo, Paul | Southwest Gas Corp. |
| Halchuk, Rosemarie | Xcel Energy |
| Hall, Stephen | TransCanada Corporation |
| Hand, John | Spectra Energy |
| Harris, Daniel G. | Columbia Gas Transmission Corp. |
| Ho, Ben | BP Energy Company |
| Huang, Stanley | Chevron |
| Kemp, Kimberly | Pacific Gas and Electric Company |
| Kinney, John | Dominion (Transmission) |
| Lew, May | Southern California Gas Co. |
| Massey, Bradley G. | Southern Star Central Gas Pipeline, Inc. |
| Maupin, Julie | GTI |
| Minto, Lisa | El Paso - Tennessee Gas Pipeline |
| Morrow, William | Telvent |
| Nichols, Carol A. | ExxonMobil Gas & Power Marketing Company |
| Ouwerkerk, Pieter C. | PECO, an Exelon Corp. Company |
| Pangelinan, Adriano | Shell North America LNG |
| Pelkey, Mark | National Fuel Gas Distribution Company |
| Phan, Thanh V. | Duke Energy |
| Poe, John | ExxonMobil Gas & Power Marketing |

| | |
|---|---|
| Reinecke, Bryan | Northern Natural Gas Company |
| Saber, Diane, Ph.D. | Gas Technology Institute |
| Salamone, Jacqueline | TECO Peoples Gas |
| Scott, E. Whit | Cheniere LNG, Inc. |
| Shah, Pankaj | Chevron |
| Smith, Frenae F. | DTE Energy Co. |
| Witte, James N. | El Paso Corporation Pipeline Group |

Christina Sames
Vice President
Operations and Engineering
American Gas Association

Ali Quraishi, Staff Executive
Engineering Services Director
Operations and Engineering
American Gas Association

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# 1 Purpose and Scope

This report is published as a guidance document to establish a common framework, as well as an industry-wide reference tool for natural gas quality and measurement provisions in contracts or tariffs. It provides an explanation of terminology and examples of representative measurement and gas quality clauses for natural gas flowing through the North American pipeline grid. Specific values or numbers in this report are provided as typical examples and are *not* intended to take precedence over existing contract or tariff values or to serve as industry-wide standards. Rather, the document describes typical gas quality constituents and parameters with associated limits employed to minimize potential end-use impacts. The primary focus is to provide technical information for use in tariffs or contracts, including checklists, that promotes the safety and reliability of gas transmission and distribution infrastructure while maximizing supply opportunities and minimizing potential end-use concerns.

Furthermore, this report provides factors to consider when evaluating appropriate limits for gas quality specifications along with a discussion of available measurement technologies referenced in documents that specify custody transfer transactions.

Specifically this report includes:

- basic measurement and gas quality concepts, including how some constituents or parameters may impact pipeline systems and end users;
- typical ranges of constituent and parameter values found in tariffs and contracts;
- definitions for most of the terms commonly found in tariff and contract measurement and gas quality clauses; and
- appendices containing general purpose checklists and sample language for tariff and contract measurement and gas quality clauses, pipeline tariff survey data and appropriate references.

# 2 Gas Measurement and Analysis Considerations

It may be necessary for parties negotiating gas custody transfer contracts or pipeline tariffs to determine whether the gas will be accounted for in units of energy, volume, or mass delivered or transported, as well as any data reporting protocols. In most instances, natural gas custody transfer measurement takes place on an energy basis. However, measurement in volume or mass units is equally important. The energy and mass concepts combine the quantitative and qualitative parameters of gas volume measurement into a single unit of measure. It should be noted that AGA Report No. 5, *Natural Gas Energy Measurement*, provides additional energy measurement detail that specifically addresses assumptions and criteria relevant to the determination of heating value and quantity of energy transferred.

## 2.1 Terminology/Units

Terms used in the gas industry, although not necessarily consistent with other currently accepted publications, have historical significance. Contracts generally refer to tariff provisions for addressing measurement and gas quality specifications. These terms are in many existing operating and service contracts that form the structure of the gas market and cannot be easily