Upstream Natural Gas Sales Verification

Producer and Pipeline Perspectives

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Introduction

Within the upstream sector of the oil and gas industry, the custody transfer of natural gas is usually determined by orifice measurement which is governed by a sales agreement between the producer and pipeline company. In most cases, the gas sales agreement references a combination of American Gas Association (AGA), American Petroleum Institute (API), and Gas Processors Association (GPA) standards which are to be incorporated into the custody measurement procedures. Verification that the physical deliveries of natural gas are accurate and accountable, for both parties, is fundamental to the business cycle that occurs each month. This paper reviews the relationships between producer and pipeline, the varying responsibilities of each party, and some useful methods to produce more accurate and accountable natural gas measurement results.

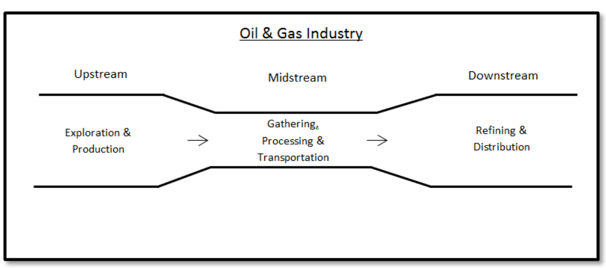

Figure 1: Oil & Gas Industry

Background

In most cases, the pipeline company is responsible for measurement of the gas being sold by the producer, including the physical meter installation and maintenance, gas quality determination, and preparation of the final settlement statement. While the pipeline has the principle responsibility for custody transfer measurement, the producer's verification of the pipeline's measurement calculations is a common, prudent, and highly recommended practice. As will be reviewed in more detail below, both parties have separate yet essential responsibilities relating to the verification of accurate and accountable natural gas sales.

Key Considerations

One of the greatest challenges for the pipeline company is to maintain an acceptably minimal "Lost and Un-Accounted For" (LUAF) between its inlets and outlets. As a general rule, pipelines strive to maintain the LUAF at less than 1% on an Mcf and MMBtu basis after accounting for shrinkage and fuel. Symbolically, LUAF is the pipeline's blood pressure, measurement is the heartbeat. Excessive differences (positive or negative) resulting from measurement error, leaks, improper accounting, etc., can cause a wide range of liabilities and have an adverse impact on the bottom line for both the producer and pipeline company.

Percentage	Upstream LUAF Chart	Tolerance
5.00		Unnaceptable +3.0 - 5.0 % or greater
4.50		
4.00		
3.50		
3.00		Excessive +2.0-3.0 %
2.50		
2.00		Acceptable +0.5 - 2.0 %
1.50		
1.00		
0.50		Optimal 0 - ±0.5 %
0.00		
(0.50)		
(1.00)		Acceptable (0.5 - 2.0)%
(1.50)		
(2.00)		
(2.50)		Excessive (2.0 - 3.0) %
(3.00)		
(3.50)		Unnaceptable (3.0 - +5.0) % or less
(4.00)		
(4.50)		
(5.00)		

These are general "LUAF" tolerances, actual measurement conditions and company policy may dictate more or less strict requirements.

Figure 2: Upstream LUAF Chart

In the authors' opinion, the single greatest cause of unacceptable LUAF is "time" or, more accurately, lack thereof. Due to accelerated monthly close-out responsibilities under which finalized energy statements are due on or before the 5th business day of the subsequent month, measurement departments have numerous pressure-packed tasks. These include collecting raw flow data files, test reports, gas analyses, equipment change reports, meter failure reports, etc., while performing required validation and editing, and furnishing gas accounting with accurate and accountable information…all within this exceedingly brief period of time. Recent advances in hydrocarbon measurement software provide the capability to automatically collect, import, and validate flow data files and records through a single integrated process, thereby providing more time to assess and identify potential sources of gas measurement and accounting errors. This integrated technology, referred to as *iMeasurement℠* in our organization, provides the greatest potential for consistently maintaining acceptable LUAF when utilized by trained and qualified measurement personnel.

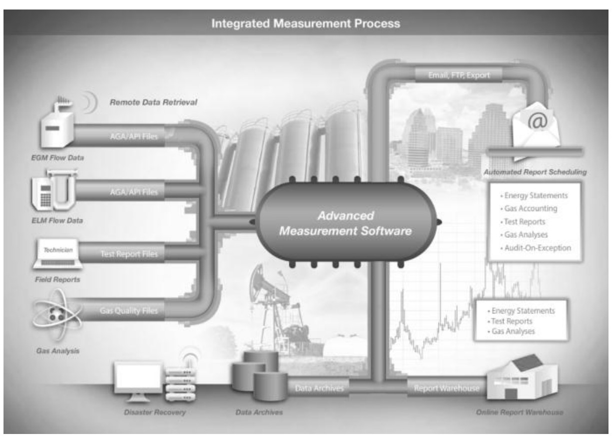

Figure 3: Integrated Measurement Process

The relationship between the producer and pipeline company inherently requires mutual trust and cooperation. While the pipeline is traditionally responsible for determining gas sales, the producer has a fiduciary, if not contractual, responsibility to verify that proper credit is received for every Btu of gas delivered into the pipeline. In order to accomplish that goal, the producer must, at a minimum, have the contractually specified right to witness the sales meter test, obtain representative sales gas samples for quality determination, perform a detailed examination of the sales calculations in electronic form, use check measurement processes and procedures, and negotiate any necessary prior-period adjustments. When professional cooperation is exercised by both parties, the result is more reliable, accurate, and accountable measurement data.

Empirical Findings

A properly installed and maintained check meter may be the most valuable tool available to the producer for verifying the accuracy of gas sales. It provides an independent means of measuring gas deliveries and can be useful in justifying an audit when unacceptable differences occur. In a comprehensive study that our company performed over the last decade, the return-on-investment (ROI) for auditing-on-exception (AOE) is approximately 15%. The standard AOE process involves initiating a detailed sales meter calculation audit when a monthly difference between the check meter and sales meter exceeds 500 Mcf and 2%. Our empirical data indicates that the combination of these verification efforts have contributed to the highest detection of measurement error which has resulted in prior-period sales volume adjustments. The most significant benefit of this check on sales may be that, once discovered, these problems very seldom re-occur, helping to ensure that the payment for gas sales occurs within the proper business cycle.

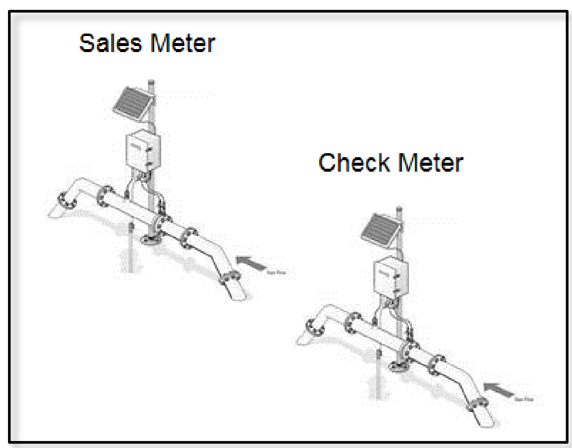

Figure 4: Check Meter Station

Another important observation regarding our evaluation of AOE is that we have been able to identify 10 sources of measurement error which have contributed to over 50% of the custody transfer discrepancies resolved between producers and pipeline companies. These observed discrepancies have involved 27 pipeline and producer measurement departments. It is important to note that these errors went undetected by both parties' validation processes and were eventually the basis of a retroactive adjustment to either the check meter or sales meter volume for the months in which they occurred. It's also important to recognize that many of these problems would not have been identified without the presence of a check measurement station. It is clear that the elimination or minimization of these top 10 sources of measurement error alone will improve gas measurement while effectively reducing expensive and time consuming prior-period adjustments.

Table 1: Sources of Orifice Measurement Error

Rank	Top 10 Sources of Error	%
1	Orifice Sizing	25.60
2	Analytical Data	21.13
3	Liquids in the Meter	9.78
4	Reported Wrong Volume	8.45
5	Compressor-Generated Pulsation	5.95
6	Set-Up Factors	5.50
7	Incorrect Estimate/Edit	5.21
8	Calculation Method	4.77
9	Meter-Out-of-Service	4.72
10	Defective Tansducer	3.29

These errors:

- Were the top 10 causes of an unacceptable difference between a check meter and sales meter resulting in 2,035 audits between 2003 – 2011
- Involved 27 producer and pipeline measurement departments
- Are ranked in order according to the percent of audits in which these problems were the primary source of the difference
- Passed through the validation process undetected

Conclusions

Verification that the custody transfer of natural gas between producer and pipeline company is accurate is of vital importance to our industry. The methods we use must be based on current measurement standards, up-to-date processes, and, of course, common sense. The data that the measurement industry produces in the upstream oil and gas sector has a bottom-line effect on royalty payments, sales gas allocations, cash flow, productivity, performance, reservoir engineering, as well as regulatory and contractual compliance. Accordingly, improvements in the quality of natural gas measurement resulting from the use of advanced technologies and processes are essential to the future of our industry.