CHART AUDITING: A NEW PERSPECTIVE

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Introduction

The founder of Coastal Flow Measurement, Jerry Fillman, authored a paper entitled "Chart Auditing: Another Perspective" in 1984. Then, as now, the relationship between buyers and sellers of natural gas, the various sources of measurement error, and the establishment of more stringent standards for orifice chart measurement are subjects for concern. While the measurement industry has seen considerable progress in the past 20 years, chart auditing has changed little. The purpose of this paper is to discuss the process of chart auditing from a more contemporary perspective.

Perspective

In our business, the pipeline company is generally audited at the request of the producer. Even with improvements in the industry since deregulation, the relationship between the pipeline and producer is unavoidably adversarial. Due to the excessive tolerances associated with chart measurement, both parties are compelled to advocate in their own best interest. The seller is seeking the highest volume determination in a given transaction, while a lower volume is more advantageous for the purchaser. Each may be quite sincere in their assertions; yet, the actual value often rests between the two.

Interpretation of chart integration continues to be a source of error, accounting for approximately one-third of all mistakes made in the measurement process. Errors are seldom the result of transposition, incorrect data entry, or the like. They are more often attributed to conscious, discretionary judgments as to where certain types of charts (i.e., the difficult ones) should be integrated. Installing an electronic gas measurement (EGM) device could eliminate this problem altogether. However, when EGM is not an option, we still recommend using faster chart rotation and/or fast-clock tests to achieve better resolution in chart patterns.

Since EGM equipment has replaced most of the chart recorders used for custody transfer in our industry, the remaining orifice chart stations have become less important. Meter stations utilizing chart recorders typically measure low-volume deliveries. Consequently, efforts to accurately measure lower volumes are becoming less aggressive. Most of the sales charts we audit are, in fact, these more difficult ones. Given the potential for financial loss or gain at low-volume sites, we believe chart auditing is more important than ever.

Benefits

In our experience, monthly auditing results in an average 4-to-1 return on investment (ROI). However, a 10-to-1 ROI is possible where properly installed and maintained check measurement systems are in place. Therefore, failing to audit by any criteria will almost certainly result in a substantial loss of revenue to your company. We encourage you to view auditing as a prudent business practice, intended to foster trust between buyer and seller. It should be incorporated as a routine part of your gas sales verification program.

It should be noted that chart auditing is just one component of a well-managed sales verification program. Your gas measurement department should develop a program that includes contract language equitable to all parties, routine witness testing and gas sampling, check measurement, effective communication between the field and the office, and professional mediation for dispute resolution.

Our audit department has recovered revenues associated with over 10 BCF of natural gas and settled more than 5,000 measurement disputes—not one of which required litigation. In addition to the obvious financial benefits, auditing also allows you to verify your own measurement procedures, identify operational problems, and correct conditions that lead to poor measurement. Furthermore, auditing offers the intangible value of knowing the other party is aware their performance is being monitored.

Check Measurement

One of the best tools available to an audit department is the check meter. Typically located upstream of the sales meter, the check meter is a separate station consisting of a primary and secondary element. Where check meters are available, the ability to identify problems and make corrections for erroneous or missing data is substantially more effective. Check meter information is frequently shared with the pipeline when the sales meter is out of service. This prevents retroactive adjustments for inaccurate volume estimates and allows the producer to receive full payment in the appropriate accounting period. In some cases, check

recorders are available. Check recorders will help identify problems that occur with the processing of the data, but will not identify problems that occur at the primary element. For this reason, a check meter station is more useful.

Categories of Error

For this discussion, measurement errors have been placed in two general categories: (1) inadvertent errors and (2) discretionary errors. Inadvertent errors, whether they originate in the field or in the chart department, are typified by number transposition, incorrect data entries, improperly installed orifice plates, etc. Discretionary errors are exemplified by misjudgments in the interpretation of charts and incorrect estimates for recognized problems. We believe it is incumbent upon the auditor to examine all possible sources of error, regardless of their origin. It is necessary, therefore, to consider all field data, documents, etc., which might influence measurement at a particular station.

Classifications of Chart Auditing Errors

Coastal Flow has analyzed over 500 adjustments obtained by our audit department from nearly 50 different companies during an 18-month period. We have identified the errors leading to those adjustments, organized them by category, and quantified them by percent of their total number as follows:

1.	Failure to apply clock factor or application of incorrect clock factor	5.43%
2.	Meter freezing, incorrectly interpreted as no-flow	3.69%
3.	Failure to integrate portion of charts	3.88%
4.	Clock stopped and static and differential were incorrectly drawn in	2.91%
5.	Integrator differences entered into computer incorrectly	1.94%
6.	Orifice plate too large to register flow	3.94%
7.	Differential and/or static pens stopped inking and were incorrectly drawn in	1.93%
8.	Failure to update specific gravity	0.77%
9.	Incorrect orifice plate size	3.11%
10.	Incorrect temperature application	1.36%
11.	Meter calibration	0.38%
12.	Meter inadvertently left out of service	1.55%
13.	Meter tube out of beta ratio	0.19%
14.	Fpv correction omitted	2.91%
15.	Incorrect pressure determination	1.16%
16.	Meter run bypass left open	0.58%
17.	Orifice plate too small--differential overranging	2.71%
18.	Chart omitted in volume computations	3.10%
19.	Orifice plate installed backwards	2.13%
20.	Tube change overlooked	0.39%
21.	Orifice plate dished	0.19%
22.	Chart calculated on 7-day rather than 8-day range	0.58%
23.	Overlooked differential range change	0.19%
24.	Transposed chart from another station	0.58%
25.	Errors in integration, calibration, and/or range	20.97%
26.	Interpretation of integration	33.88%
Total		100.00%

Final Comments

Orifice chart measurement has often been described as “part art--part science” due to the subjective nature of the process. As a result, we believe auditing is the only way to verify whether you are receiving credit for every Btu of gas either purchased or sold. With proper maintenance, electronic gas measurement is inherently more accurate than meters utilizing chart recorders. However, many of these vintage sales meters continue to be in use. The incidence of random error associated with electronic gas measurement is similar to that of orifice chart measurement; however, we are confident the industry will continue to reduce EGM problems. Software systems which automatically identify unacceptable measurement conditions, business demands to prevent prior period adjustments, and increased attention to measurement based on rising gas prices all contribute to improvements with the EGM process. With advances in technology and closer attention to business, auditing will continue to generate a positive return on investment regardless of the type of orifice measurement equipment used.