

Electronic Gas Measurement Auditing

Perry Dee Hummel

Atlas Pipeline Mid-Continent LLC

Tulsa, Oklahoma

Gary P. Menzel

Coastal Flow Gas Measurement, Inc.

Houston Texas

Introduction:

Electronic gas measurement auditing or EFM auditing is a very important process in the natural gas industry. Within the last twenty years, the natural gas industry has changed from the dry flow chart recorder to the Electronic flow Computer(EFM) as the primary method of recording the measurement data for custody transfer.

These flow computers are still typically connected to an orifice meter and are subject to all of the problems in the primary device that a chart recorder was. In addition they have their own set of problems that crop up in the flow computer and transmitters, some of which had similar problems when it was a chart recorder and some of which are unique to the flow computer. Careful review of the meter data should still be (and usually is) a part of the monthly close process.

Even with the review process, occasionally measurement errors make it through to the payment calculation. It is for this reason that auditing is necessary and prudent. A proper audit procedure can be cost effective and ensure that proper credit is received for any delivery. As a side benefit, it will also help ensure that internal measurement is being performed properly.

Define the Process:

A successful audit program depends upon a lot of different variables. One of the keys to success is consistency, proper documentation and a good field measurement process.

Sophisticated computer systems are not required to maintain and review monthly system and check meter vs. sales balances. All it requires is a simple spreadsheet and access to all of the gas into and out of your system(s).

Outline of the auditing process

- Set up your balance (or balances). This can be done within the measurement system but it can be done in a spreadsheet, within a SCADA

system or even on a piece of paper if small enough.

- Compare the Sales volumes to Sales Check measurement volumes or system volumes (if different). If all three exist, compare all three (this will help identify where the problem is, if two out of three agree).
- If there appears to be a problem with third party data, prepare a written request for the detail measurement data from the third party. Be sure this request includes all pertinent data including Flow computer logs, edits performed, calibration and inspection reports and gas analyses. In addition if a problem is identified for June, it is prudent to request data as well since the decision to audit was made on the basis of monthly volumes. Similarly if a problem exists in June but July looks better, July's data should still be obtained. It often helps to identify what the problem was by seeing exactly what changed when the problem starts and ends. It is important to request all of the third party data needed as soon as possible as obtaining this data is often the rate determining step in correcting the problem.
- Conduct your review; and if a problem is found in the third party measurement, submit your findings to that party requesting an adjustment if warranted. Be specific as to the problem identified, the adjustment amount requested be sure to provide all supporting documentation when submitting the adjustment.
- Make sure to follow up with the third party if you do not receive an adjustment or at least a notification of why such is not due (which may require further review). Once the measurement adjustment has been received and reviewed, make sure to notify all downstream users affected by the adjustment via a prior period adjustment (PPA) notification of some sort.

These parties typically include your production accounting and operations groups at a minimum.

- Log a record of the adjustment in your measurement system (and also your balance system if not the same). Make sure you keep all of the documentation and reasons for the adjustment (the same problem may affect future months or other stations).
- If the problem is determined to be within your own measurement process, evaluate it to see if there need be modifications to the process to prevent reoccurrence. If the measurement in question affects accounting, be sure and make PPAs as required.

API Chapter 21.1

API Manual of Petroleum Measurement Standards, Chapter 21.1 defines the minimum necessary data to evaluate gas measurement utilizing EFMs and perform edits in order to recognize problems and to correct for them if they occur. While there are many different gas flow computers on the market and many different company defined measurement programs, all should be able to provide measurement data that meets these requirements if utilizing EFMs for custody transfer or sales check meter measurement.

They do not guarantee good measurement! In order for good measurement to be achieved, the proper equipment must be utilized, it must be properly maintained and good communication between the field and the office must exist. While it is convenient to say that the field often does not let the office know what is wrong, the opposite is also true. The field device cannot be properly configured unless the technician is told what the proper (usually contractual) configuration is. Also measurement technician may be at a given measurement station once per quarter for one hour. The office may see problems occurring between these visits and should notify the appropriate technician when they see an ongoing or reoccurring problem. A technician may not be able to fix all problems but are much more likely to be able to if they know about them.

In addition to the meter technician and the measurement analyst in the office (who are both measurement personnel) good communications between operational field personnel and measurement is also critical. While the measurement technician may be scheduled to visit a site once a quarter, operational personnel are often at the site five or more days a week. If they communicate problems to measurement they can be resolved faster (often before they initial close). This is true not only of the companies measurement but also of the third parties

(sales) measurement stations (if accessible). Also operations generally has a better idea of when flow rate changes are likely to occur which may require measurement equipment changes to properly measure.

Measurement Errors:

Volumetric discrepancies can result from many different causes. Coastal Flow has kept statistics on what errors they have found in performing EFM audits and listed below are the 10 most common. It is important to note that these are errors are ones that got through the original measurement review process. They were greater than 500 Mcf for the month and also greater than 2% of the total measurement at the station (a minimum threshold commonly used to trigger an audit) and that in these cases the month was selected for audit based upon a comparison between a sales check meter and the custody meter. Many of these errors where only identified by the presence of the sale check meter. There are over twenty five measurement departments involved (including Coastal Flow Gas Measurement) in this tabulation, so while it may not represent your experience, it is reasonable for the industry as a whole. Some of these errors ended up being in the check measurement, some in the sales measurement and some in both.

Common sources of measurement error:

The following is a tabulation of errors found in 2791 measurement audits over the last 13 years.

Measurement Error	Per Cent
Analytic Data	18.82
Plate Sizing	18.08
Liquids in Meter	8.34
Pulsation	5.69
Incorrect Estimate	5.77
Set-up Factors Incorrect	4.34
Meter Out of Service	4.17
Meter Freeze	3.92
Calculation Method	3.77
Defective Transducer	3.05

Identifying these errors involved reviewing the periodic measurement data and comparing it to the same periods in the check meter, Meter Configuration logs, Alarm Logs and Meter Event Logs. It also involved reviewing the test reports, meter inspection and calibration reports, equipment change reports and the gas measurement and quality sections of the contract. Sometimes, additional field tests were conducted to identify the problem.

Most of the problems with EFM measurement are identified and resolve in the initial measurement review process. The two, probably most common issues with EFM gas measurement, Missing Data and Calibration Errors don't even make the top ten list. The industry, by and large, does a very good job of recognizing and resolving these issues.

Commercial Impact:

The previous paper on this subject talked about the recent increase in gas prices. Currently gas prices are lower. Depending upon your company it may be even more important to make sure you get proper credit for your sales when prices are low (due to tight margins) than when prices are high. That extra \$20,000 per month might be the difference between a profit and a loss. Whether you are buying or selling it always makes sense to pay attention to the other party's measurement as well as your own and audit when necessary. The only change is what constitutes enough discrepancy to warrant an audit. Ongoing discrepancies justify audits at lower

levels than one time discrepancies because these problems are unlikely to go away until they are fixed, and this is true even if the amount does not justify a PPA. If you are conducting external audits using sales check measurement you are also, auditing your internal measurement process. Occasionally though the check measurement and sales measurement match there is a big enough discrepancy between inlet numbers and the outlet on a gather system to justify a complete audit of all of the internal meters in the system. Many times though these meters are considered "allocation" meters they are custody to someone (because the working interests or royalty interests is not the same in all of the wells, someone's payments are being affected). Any findings of problems with your internal measurement can and should be used to evaluate your entire measurement process. If you are party being audited you should take advantage of the other party's finding to review your process as well.

Summary:

EFM auditing still depends upon many of the same primary devices (orifice meters) as the old chart methodology did. There are problems unique to the utilization of EGMs. Sometimes these problems get through even the best measurement review process. Your check may be for the wrong amount. Even when prices are low, auditing is still justified, by reviewing your balances and performing measurement audits as necessary, you can positively impact your bottom line.

"Trust but verify" President Ronald Reagan