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# **Auditing Measurement and Gas Accounting Systems**

Class #7040

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## **Introduction and Purpose**

With the larger volumes today's Transmission companies are moving, the need for accuracy gain more credence to ensure the correct volumes and Dth are being accounted for. A few years ago a 2,000 MCFH station was considered to be large now we have many stations moving 20,000 MCFH. As we deal with larger volumes we also deal with many more dollars than before. Acquiring and processing flow data is becoming increasingly complicated as we have changed from a buyer and seller of natural gas to producer, gatherer, and transporter of the commodity. Many additional types of measurement equipment have become available and with them more requirements for accuracy and accountability. Increased technology has led to a need for additional data bases, edits and reviews to maintain the expected accuracy.

Understanding what a MCF / Dth is and how they are obtained is necessary to ensure an accurate audit of the systems creating and managing the data. This accountability requires a Measurement Audit to ensure the flowing conditions and measurement data are correct from the actual receipt point to the end of the billing cycle. The audit can be driven by a specific issue or problem or a routine audit to ensure all contracted procedures are being followed. The following procedure would be used by either driving factor for the audit.

## **Collecting Auditable Data**

Beginning a measurement audit requires obtaining a copy of the contract or operating agreement. A thorough understanding of the contractual conditions and the volume calculation basis for the type meters being audited is most valuable. The more the auditor understands the laws of natural gas the more in depth the auditor can inquire into the measurement process. Many companies have specific standard conditions set forth in the agreement that must be executed during the volume calculation process. The contract should define some of the measurement terms like "MCF", "Pressure", and "BTU". These conditions can be either entered into the EGM or volume calculation process. Most companies in North America utilize the AGA/API standards as the basic volume calculation methodology. Depending on the meter type Orifice or Linear the appropriate standard can easily be verified and should be used. A copy of the gas meter statement and the original flow medium (chart or hourly flow records) must be obtained for the period of the audit. Any flow data used in the volume / Dth calculation needs to be acquired to allow the auditor a method of following the measurement process. If the flow median is an EGM then a copy of the configuration and audit log would be required. With these documents a good through audit can be accomplished. The contract is the road map to ensure the volume / Dth are consistent within the measurement and accounting system. In some cases a company tariff is utilized instead of a specific contract. It too should cover the necessary requirements as listed above.

### **Gas Meter Statement**

This is the basic report that should indicate a great deal about the flowing conditions and the flow meter it-self. The auditor should acquire a copy of the gas meter statement from the party responsible for the measurement for the period of the audit. This document is the most common report used in the natural gas industry for documenting monthly flowing data. The use of it should allow one to review the type meter, collection method, meter data and associated volumes. Some the items that should be on the statement are month and flow dates, contract pressure base, Atmospheric Pressure, Meter type (Orifice/Linear), Orifice size, Tube size, Date, Volume Calculation Basis and Flow Data from the meter. Orifice meters should report orifice plate, meter tube, and note any changes during the month. Linear meters should have the meter factor and or K-factor. Additional items could be contract hour and calculation methods (AGA3, AGA 7 and or AGA8). Most gas meter statements detail the flow data to the individual day and should include meter specific flow data pertinent to the type meter. All meters should include flowing time, average gravity, N<sub>2</sub>, Co<sub>2</sub> and BTU. Orifice meters should include the daily average flowing pressure, temperature, differential pressure. Linear meters should daily average flowing pressure, temperature and flow time, pulses count and uncorrected volume. The intent of the gas meter statement is to report the volume/ Dth and flowing meter data and metering conditions (plate size, K-factor, Etc.) that are subject to individual meter changes that could affect the volumes. The statement is also readily available to be used to validate the flow volume at a high level.

### **Reviewing Data**

The first review would be to compare the Gas Meter Statement against the contract to ensure the volume and Dth are using the correct base conditions. A basic volume calculation for the periods against the reported calculation needs to be performed to ensure the conditions listed are correct. While the exact volume may not be recalculated they should be fairly close depending on the steadiness of the flowing conditions for the period. If there is a significant difference then there is an issue to review. If it is an orifice meter some additional things to review are Beta (meter tube/orifice size) to ensure it meets the contract and flowing D/P. If the Beta is out of range of the standard the volume could be affected adversely. Low D/P or D/P over ranged can and will also cause significant unknown error. The volume

### **Gas Measurement System**

The Gas Measurement System is the location of the original data base whether it is from a chart or EGM. This system can be an EGM collector and editor or Chart processing system or the combination of the two. This system is where the basic calculation process takes place and also maintains the individual standard programs for volume and Dth calculations, for all meters in the data base. The system is usually dynamic and can handle both import and export of all volume data. It usually maintains the individual meters and stations as individual so as to report as needed. The original data from a chart or EGM is secure and cannot be altered. The original data can be updated as warranted but using revisions rather than actual replaced. This system does do calculations and reports as necessary. Each meter has its own configuration file and analysis file to do complete volume / Dth calculation or recalculation as needed. This system is also the used to edit and report measurement discrepancies. It should able to compare the flowing conditions of individual meters or groups of meter at a location for abnormal conditions that are detected. It should be able to handle the lowest lever of EGM and Daily chart measurement data. The system should be able to receive measurement and gas analysis data and able to calculate necessary Dth and corrected volume. The daily volume / Dth output should be traceable back the original volume medium and to the account system. Any changes or calculations should be stored and maintained for audit.

### **Orifice Chart**

To obtain an accurate volume for the chart the original chart needs to be reviewed and even retraced where possible. The audited flow data may not match exactly but should be in a reasonable percent difference depending on the movements of the individual pens. Most auditors do not have the expertise or equipment to retrace a gas flow chart on a chart integrator, but they can review and validate some of the flow records. If there is a need to retrace the chart, a third party, chart Service Company can easily be found. To complete a full audit the original and or retraced flow data from the chart would need to be recalculated using the same conditions as indicated on the gas meter statement. The recalculation can be done by hand or one can use many of the volume calculation programs available. A review of the chart would include a visual review of the pen (Pressure and Differential, some recorders include Temperature) are marking for the necessary time as stated on the back of the chart. One needs to note any missing or erroneous recording and comparing them to the reported averages. Review the recording side or any missing data, over / under ranges, or any data that appears to be false. Any notes written on the back or face of the chart should be reviewed and noted. The original integration flow data should be stamped on the chart and traceable to the gas measurement system responsible for the volumes.

### **Linear Chart**

Review the face of the chart for the cycle (related to uncorrected volumes from dials), Pressure, and Temperature. Most of the time chart data is read by hand. The cycles should match the registration difference between the start and end reading. Review the recording side or any missing data, over / under ranges, or any data that appears to be false. One of the most important issues in reviewing this type chart is to compare the cycles (loops) to the registration difference on the back of the chart. This type meter records the continuous flow for the meter with some type dial. The dials should be read when the chart is put the recorder and when it is removed. The difference is the volume uncorrected for actual flowing conditions and should relate to the cycles on the face of the chart. Each recorder can be different but the comparison is usually in relation to 1, 10, 100 or 0.5, 5, 50. Any notes written on the back or face of the chart should be reviewed and noted. The original flow data should be written on the chart and traceable to the gas measurement system responsible for the volumes.

### **EGM**

If the recording medium is an EGM then the auditor needs to request the daily and lowest incremental of original flow data available. Usually this is the hourly level volume data which should sum up to the daily data also acquired. The data included in the flow data is similar the data requirements of the gas meter statement and can be used to recalculate the actual reported volume/ Dth to the lower incremental level. Since this data is reported in a much shorter period than the statement, the audit volume should be more in line with the actuals. The original flow data would be prior to any editing taking place. Also ask for the edited flow data and comparing the volumes to see if any changes had been made. If there are changes note and ask for any documentation to support the changes. The original flow data and volumes information should be maintained in the unit for 30 days and traceable back the original gas measurement system responsible for the volumes. Most EGM's utilized in America meet the API Chapter 21.1 in reference to audit data.

The auditor should also request and receive the EGM configuration (characteristics) and any event log along with any alarms. The configurations should match what is on the gas meter statement but may have a more detailed list of parameters used for the gas calculation. Some of the additional parameters listed could be atmospheric pressure, temperature AGA 8 method, and tap location. The event log should report any changes to the unit during the period being reviewed and can also report conditions and changes not listed on the statement. Some of the

items to look for are parameter changes, time changes, warm starts, and over ranging. The event log should give the auditor a good feeling of how well the unit is functioning and display any changes to the unit for the period of the audit.

A review of the Gas Analysis is necessary to ensure it also meets the standards set in the contract or agreement. Some things to look for is Pressure base, Standards being referenced and whether or not the Heating value is stated as Gross (Dry) or Net (Wet). It is wise to review the current analysis against historical analysis to acquire a feel for periodical changes in the analysis.

As the industry becomes more accustomed to EGM's increasingly faster and more accurate flow data is expected. It is necessary to maintain controls and yet not slow down the data transfer from the EGM at the meter to the customer. In the past the gas chart and Gas Meter statement were most of the audit trail, now with electronic metering, data is created and stored faster than ever before. Different type meters create additional auditable data. Some of the newer meters being utilized for gas measurement can self-diagnoses their self to indicate metering issues. This process also lends to additional reviews, test and documentation.

### **Audit Summary**

The audit function is designed to ensure the accuracy of the final billing volume and Dth. The main purpose of the audit is to ensure original volume or documents representing the volume are being utilized and processed though out the many different systems and ensure their validity and documentation. This process is in-depth and does take a fair amount of knowledge of the gas laws and standards being unitized in industry today. An understanding of each type meter is necessary to visualize what the meter flow data is reporting. Natural gas by nature is affected by many different conditions and the product itself is usually a mixture of many different components. The understanding of the gas stream and the effect of each condition is why a careful and full audit is warranted.