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ECONOMICS OF ELECTRONIC GAS MEASUREMENT

Class # 3110
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INTRODUCTION

The intent of this paper is to address the economic impact of Electronic Flow Measurement (EFM) equipment in place of traditional systems. Orifice Tube measurement will primarily be discussed because it is the most common in the natural gas industry.

The following topics will be discussed in this paper:

1. Traditional Measurement Equipment
 - a. Chart Recorders with Meter Tubes
 - b. Turbine and Rotary meters with Counters
 - c. Gas Laboratories
 - d. Gravimeters, Calorimeters, and Thermal Titrators
2. Comparisons between Chart Recorders and EFM's
3. Economic Justifications
4. Accounting Systems
5. Automation

TRADITIONAL MEASUREMENT EQUIPMENT

My introduction into the natural gas industry was in 1984 as a Gas Laboratory Analyst for Transok, Inc. The laboratory was part of the Measurement Department and some of my responsibility was assisting the Measurement Specialists with installations and special projects. At that time, the most common gas measurement equipment was chart recorders and orifice meter tubes. In a few locations, Transok had rotary meters at Farm Taps and a few Turbine meters at Electric Plants. At plants and major sales points, Transok used automatic chart changers. Recording Gravimeters, Thermal Titrators and Calorimeters were used to determine gravity and BTU's. On-line Gravimeters, Thermal Titrators and Calorimeters had strip chart recorders initially. The first EFM was installed in 1985. By the mid 1990's, chart recorders were almost completely phased out. Measurement stations with over 1 MMCF/day received continuous samplers driven by EFM's to produce proportional to flow MMBTU calculations. Sales meters with over 25 MMCF/day used on-line chromatography with an EFM to produce Real Time Measurement.

COMPARISONS BETWEEN CHART RECORDERS AND ELECTRONIC FLOW METERS

The Primary Device (Orifice Meter) usually is similar and must follow AGA3 guidelines for both types of Secondary Devices (Recording Devices). The chart recorder and EFM are not meters but recorders. The Tertiary System (office system) or data collection and calculation processes probably made some of the most significant changes.

- Collection of data - Charts are collected depending on whether a 1,7,8,16 or 31 day chart is in service. When 1 day charts were used an automatic chart changer might be installed so physically driving to the location daily was not necessary. EFM collection may be done monthly using a hand held device, laptop computer or remotely.
- Accuracy – EFM's sample more frequently for differential, static and temperature and are more readable especially in plunger, intermittent flow pattern applications.
- Wider range of flow rates – differential and static ranges may still be measured accurately if ranges are exceeded. If the chart readings are more than 100%, the excess may only be estimated.
- Direct application of gas quality – molecular percentages, gravity and BTU may be entered directly in the EFM on site. Real Time Measurement may be performed with an EFM and on-line chromatograph for custody transfer applications. Portable chromatographs may also be used so quality data may be entered in the field. Stations with chart recorders must have gas quality values integrated and calculated into the flow equations in the measurement processing program. Usually spot samples are obtained, taken to a laboratory, analyzed by a laboratory chromatograph and the analysis results sent to the contract or company measurement office for processing.

ECONOMIC JUSTIFICATIONS

Economic justification will vary according to single well operations, gathering, processing and transportation systems.

- Initial costs - These costs are usually more easily justified during first flow conditions when wells are at their maximum flow rates.
- Experience of field and office personnel – If the company has experienced personnel, costs may be minimal by reducing training and travel expenses to outside sources.
- Equipment costs – Hardware and software for field and office applications must be considered when the justification process is made.
- Company pay out guidelines – Most companies have guidelines in months or years for the amount of time the costs are to be recovered.
- Less mileage for field personnel – Remote locations are sometimes easier to justify because it would be uneconomical to be on site frequently.
- Operation by exception – Daily focus on problem stations by priority may be determined using EFM's. Alarms for tanks, compressors, operational equipment, casing/tubing pressures and measurement readings may be evaluated remotely allowing operational or measurement personnel to prioritize work for the day, creating less down time or identifying hazardous situations. More locations of responsibility per field employee may be possible.
- Improved production – EFM's have the capabilities to control all operational equipment at a particular site. Charts would require multiple devices for each operational function.
- Pipelines & Gathering systems – EFM systems make data available for producer access and operations on a daily basis. Remote communication allows daily system balances, nominations and volume statements to be accessed.

ACCOUNTING SYSTEMS

- Data formatted in spreadsheet form - Auditing comparisons are available on a daily basis. System balances may be transferred internal or externally.
- Paperless audit trail versus charts and gas analysis reports— EFM data may be archived in computers versus hard copy storage of charts saving thousands of dollars. Retrieving data for audits is quicker and easier. Prior period adjustments are also possible with remote communication using EFM's. Laboratory gas analyses and other hard copy reports may be scanned and retained in a file to provide a total electronic measurement system.
- Remote data collections – Remote collections allows measurement data systems to close pay periods sooner.
- Less human flow interpretation – EFM's take the human factor out of the results if the correct values are entered. Chart Integration may be biased depending on a particular machine, operator or chart evaluation by office personnel.

AUTOMATION

Operational Automation has unlimited value at large measurement stations or wellheads with tanks, plunger lifts, intermitters, gas quality analyzers and other operational equipment.

- 24/7 Operations monitoring – Remote communication allows frequent monitoring of compressors, pressures, tank levels, processing facilities and other devices.
- Alarms – Alarms are capable of notifying operational personnel of compressor shut down, tank truck call outs, and other undesirable operational and measurement readings.
- Environmental benefits – Fines may be avoided if spill prevention, gas venting, H2S concentrations and other hazards are detected before overages occur.
- Camera option – Photography installation may be monitored remotely preventing theft and other security concerns that dollar amounts are difficult to estimate.
- Plunger enhancements – Increased production may be monitored and optimized with plunger lifts controlled by EFM's.
- SCADA – Allows more real time data access to all company personnel.
- Safety – Avoid unnecessary visits to locations during undesirable conditions.

CONCLUSION

Electronic Flow Measurement has many advantages over Chart Recorders. EFM's have better sensitivity and data may be retrieved remotely by a variety of groups. Automation may be controlled and adjusted remotely saving valuable dollars in maintenance and labor costs. Spreadsheet applications make auditing, system balances, archive data and reports easier to produce and retrieve. The justification process and costs must be considered. Equipment justifications are usually the easiest to accomplish when stations or wellheads are in the initial planning stages. Transmission, gathering, production and allocation measurement has greatly improved with the installation of EFM's.