Benefits around Timely Analysis of Measurement Data
Class # 8240.1

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Purpose

Verifying measurement data can be challenging. Challenges include processing an overwhelming amount of data, choosing meaningful data types and validation criteria, and validating the data in a timely manner. Failure to meet these challenges can lead to undesired outcomes such as inaccurate measurement results, prior period adjustments in accounting and increased costs.

To efficiently and accurately validate measurement data for the monthly cycle, a number of things must be evaluated and implemented. Considering these topics in advance will help resolve anomalies and outstanding issues:

- Identification of the types of data that should be validated
- Understanding of what type of analysis and validation checking is available to better identify data problems
- Effectively setting validation tolerances to correctly identify data anomalies
- Resolving problems after suspect data has been found

This paper will describe the challenges associated with validating large amounts of data points and discuss the benefits of using an automated method to verify the accuracy of data that flows through a measurement department.

Definition of "Timely"

The word "timely", as it relates to validated measurement data, can mean different things for various reasons. The type of data it is, consumers of the data and the data usages all factor into different timeliness definitions. Some usages of measurement data require validation only at the end of the production month and allow for technologies such as charts and manual flow computer collections to be sufficient for consolidation of data for validation. Other usages require hourly data leveraging frequently polled EFMs to consolidate the data for validation quickly enough to make important business decisions. The validation methods discussed in this paper are meant to support the business practices, procedures and equipment that are in place to achieve what is required for timely validated data.

What Needs Validating

Flow computer technology has provided the industry with the ability to calculate quantities and create data records at very quick intervals resulting in better accuracy. Measurement departments are tasked with validating these vast amounts of data, correcting issues and reporting on the results. Central office measurement systems provide the tools to assist with the consolidation, validation, recalculation and reporting of measurement data. However, to achieve the needed accuracy, measurement systems must save historical records at frequent intervals. At one time, daily and monthly quantity records were sufficient but today a common interval is hourly. A

result of increasing the quantity record resolution to hourly is greatly increased amounts of data that must be validated.

An example of the amount of data validations that can occur is illustrated by focusing only on the quantity record. For an orifice meter, the parameters that are being validated for the purpose of this example are:

- Differential Pressure
- Static Pressure
- Flow Time
- Flow Temperature
- Volume
- Energy

Assume for this example that there are 100 meters producing hourly data for the period of one month. This will require 446,400 data points to review.

Meters	Days	Hours	Total Records	Data Points	Total Validation Points
100	31	24	74,400	6	446,400

Manually reviewing each data point is not feasible as it would take 248 man-hours assuming 2 seconds are spent on each data point.

Total Validation Points	Review Time in Seconds	Total Hours	Hourly Salary	Monthly Cost	Annual Cost
446,400	2	248	$30	$7,440	$89,280

Validation of measurement data is not only concentrated on the volume, energy and flowing parameters. Other aspects must be verified and validated to ensure accurate results. Below describes some of these areas:

- Quantity Records – These records have multiple data points that can be validated to shed light on a variety of issues that could have occurred during the generation, storage, calculation and collection of data. Depending on the meter type, examples of data points validated can include:
  - Differential Pressure
  - Static Pressure
  - Flow Time
  - Flow Temperature
  - Integral Value
  - Uncorrected Volume
  - Pulses/Counts
  - Volume
  - Energy
  - Mass
- Gas Quality Records– Sample analyses must be validated to ensure only accurate compositions are used for quantity calculations and for production accounting. Samples can have many data points that require validation, including:
  - Mol Percents
  - Extended Component Molecular Mass and Density
  - Heating Values
  - Compressibility
  - Specific Gravity
- Calibration – Meters and instruments must be verified to be operating as expected. When meter inspections reveal operating conditions outside of allowable tolerances, calibrations must be performed and those results reported in a timely manner to the measurement system.
- Configuration – Meter configurations must be entered correctly into the devices performing calculations. As changes to the configuration are made, they must be updated in all related systems such as the EFM and the measurement system.

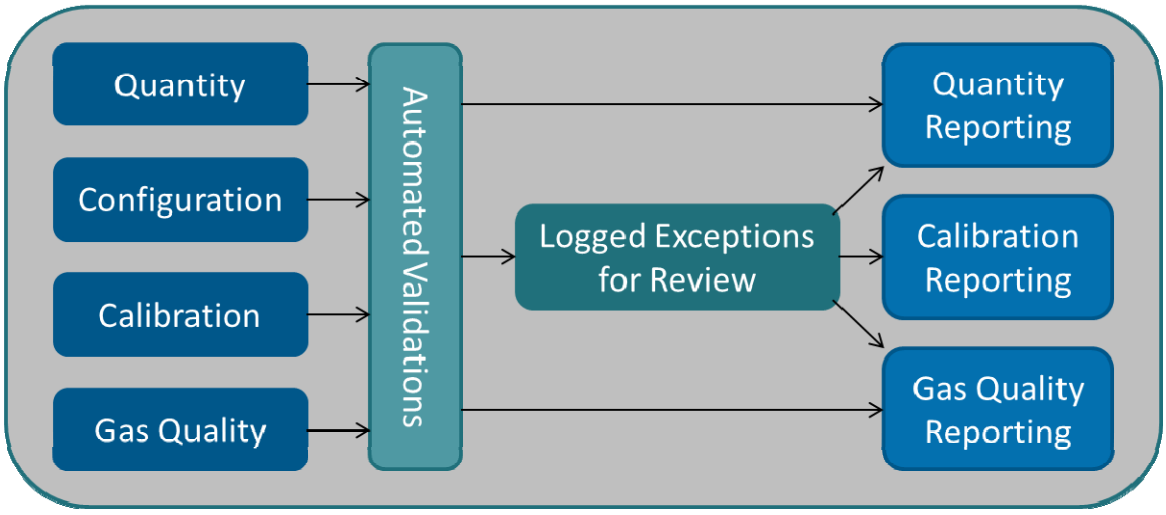
Not only is validation of successfully captured data required, but additional validation should occur to indicate if any data is missing.

Automated Approach to Validating Data

A manual approach to validation requires many hours be spent approving data that have no issues just to find the subset of data that does require review. Automating this approach with effective methods allows for a system to identify and flag only the suspect data while the majority of the data passes validation without requiring manual review.

A computerized central measurement system can assist in many kinds of automated validation. Continuing on with the areas of validation previously mentioned some automated solutions will be discussed.

- Gas Quality and Quantity Records – Validation limits can be established that create ranges in which to place new measurement data points. This can result in acceptable values, values that exceed the acceptable ranges resulting in warnings and values that exceed the warning ranges resulting in failures. Effectively setting these validation limits will allow for a majority of data points to be reviewed and hopefully approved without any human interaction. In some situations, a group of meters can adhere to the same limits and these limits can be managed at the group level. In other situations each individual meter may need to be managed at that specific meter level. There are multiple techniques to setting meter level validation limits. Some include manually setting a static range while others utilize the meter's history to dynamically set the range as a percentage above or below the average or a number of standard deviations.
- Calibration – The process of transferring calibration results from the field to the central office can be automated if those results are electronically captured. Many benefits exist as a result of electronically capturing these results:
    - Enforced company polices by requiring complete results and specifying allowable operating tolerances
    - Reduction of human error through immediate validation of calibrated results
    - Reduction of duplicate data entry
    - Automation of results to central office reduces the cycle time required to review calibrations and adjust quantity records, if required.
- Configuration – Station and meter configuration data can automatically be validated if a snapshot of the flow computers setup can be provided to the measurement system in a timely manner. The characteristics of that meter captured in the snapshot can automatically be compared to the measurement system and alert measurement personnel when discrepancies exist.



A case study of 100 meters producing hourly flow in a production system utilizing an automated approach of validation on differential pressure, static pressure, temperature, flow time, volume and energy resulted in 16,260 exceptions for review and resolution. Applying the same time and hourly wage values as the previous example results in:

Total Validation Points	Review Time in Seconds	Total Hours	Hourly Salary	Monthly Cost	Annual Cost
446,400	2	248	$30	$7,440	$89,280

Without Automated Validation

Total Validation Points	Exceptions Requiring Review	% Automatically Approved	Annual Cost for Full Manual Review	Annual Saved Cost after Automatic Review
446,400	16,260	96.4	$89,280	$86,028

With Automated Validation

Who is Affected and What Benefits Do They Gain

Many different parties benefit from receiving correct, validated measurement data on a timely basis. Contracting parties, production accountants, regulators and custody measurement parties are just a few of the groups that gain better results and make better decisions based on this information.

Some of the benefits that these parties realize are:

- A reduction in manual data inputs – Computerized measurement systems allow for the collection and consolidation of measurement data automatically which reduces the potential errors involved with human entry.
- A reduced cycle time – This is achieved through automation of data between the field and office as well as automated validation processes. Automation allows parties to receive information faster for quick business utilization.
- A reduction in adjustments – This is accomplished by having the system validate all data providing the analyst only suspect data to investigate and correct. Prior period adjustments (PPA) can be costly. In a case study analyzing the cost for a single meter PPA it was found that on average it costs $180 per PPA. Reducing the number of PPA's generated in a year can have a significant impact on cost.

Average Hours Involved with Resolving a PPA	Average Hourly Salary	Average PPA Cost	Annual Measurement Sourced PPA's	Annual PPA Processing Cost
6	$30	$180	1000	$180,000

- Increased Value – This is realized through delivering more accurate data and results to all parties involved.
- Reduced Cost – Through a reduction in PPA's and elimination of the manual review of all data, costs saving can be achieved.

Conclusion

In conclusion, the increase in the amount of data that flows through a measurement department has made it unrealistic to validate it for accuracy without the help of computerized measurement systems. These systems can automatically review all data entered and report on just the anomalies that require investigation. The time saved from reviewing good data can be better spent on correcting bad data and improving on processes to prevent bad data from continuing. The end result is a more accurate production month on which to base important business decisions and accounting results on.