Manual of Petroleum Measurement Standards Chapter 13.2, Part 2

Statistical Methods of Evaluating Meter Proving Data

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Introduction

Minimizing petroleum measurement errors, estimating remaining errors and informing affected parties of errors is important to the petroleum industry. A consistent basis for estimating the size and significance of errors is essential for communication among affected parties.

A fundamental source of measurement error is the instability of the meter factor. Meter factors are monitored to gain confidence in the reported volumes and to detect trends or sudden deviations as indications of when to perform maintenance on or calibration of measurement equipment. The purpose of this standard is to suggest procedures for monitoring variations in meter factors so that uncertainties are understood and consistent with the objectives of parties affected by the measurement operations. The procedures for monitoring meter performance, limits on meter factor variations and actions to take because of these variations are left to the agreement among the parties affected by the measurement operations which can depend on company policy, contract agreements, regulations and laws.

Statistical Methods of Evaluating Meter Proving Data

1 Scope

This standard establishes the basic concepts and procedures to estimate and report meter performance uncertainty in consistent and comparable ways.

2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the reference document (including any amendments) applies.

API *Manual of Petroleum Measurement Standards* (*MPMS*) Chapter 4 (all sections), *Proving Systems*

API *MPMS* Chapter 5 (all sections), *Metering*

API *MPMS* Chapter 12 (all sections), *Calculation of Petroleum Quantities*

3 Terms, Definitions, Abbreviations, and Acronyms

3.1 Terms and Definitions

For the purposes of this document, the following terms and definitions apply. Terms of more general use can be found in the API *MPMS* Chapter 1, *Online Terms and Definitions Database*. Acronyms are defined in the text at first use.

3.1.1
Three standard deviation limit
A control limit equal to 3 standard deviations from the arithmetic mean of the set.

NOTE For a set of normal data this limit is also known as the 3-sigma limit.

3.1.2
control chart
A graphical method for evaluating whether a process is in or out of a state of statistical control by using warning and action limits determined by statistical analysis of the process data.

3.1.3
meter factor log
A table for recording meter factors and associated data in chronological order.

3.1.4
normal
The designation for a set of data that exhibits a Gaussian distribution.

NOTE In this standard, all references to “normal” and associated word forms (normality and normally) are meant in the “Gaussian” sense and not in the “typical” sense.

3.1.5
rational subgroup
A grouping of measurements chosen in such a way that variations within the group and subgroups are independent and random in nature.