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PVT Data Quality: Round Robin Results

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Abstract

Compositional data is a vital input to many engineering models, including the calculation of the mud free properties of reservoir fluids sampled by repeat formation testers and calculating the value of gas sold on a calorific value basis. For all such applications, the quality of compositional data is of critical importance. The impact can be material in a wide range of issues, including reserves estimation, facilities design, gas hydrates prediction and sales gas valuation. The main aim of this study was to set quantitative criteria for screening laboratories prior to tendering for a PVT contract.

Reliance on contractor quality assurance procedures is not sufficient. Routine internal consistency checks may not identify some of the errors. Evaluation based on analyses of identical field samples relies on one data set being of high quality, an assumption that may not be correct. There is a need for an independent supplier of high quality gas, liquid and live fluid samples of accurately known compositions that can be used by laboratories to demonstrate the quality they can achieve to the oil companies before unique and valuable samples are sent to them for analysis.

The results of a "Round Robin" evaluation of PVT laboratories around the world are presented. A set of identical samples was sent to each laboratory – 3 dry gases, 3 stock tank liquids and one live sample. There was considerable variation in the quality of compositional analyses reported. A small minority of the laboratories tested generated compositional data that fully met the highest quality measures for both gas and liquid analysis. A similar number were close to meeting these standards, but the majority generated data that was deeply flawed in some respects. In one case, interpretation errors resulted in 24% reduction in C4+ in all the gases. The resulting calculated calorific values were as much as 5% low – a large potential loss of value if used to calculate the value of sales gas. All laboratories were given feedback, and some are actively engaged in resolving the problems identified.

Introduction

Laboratory measurements play a critical role in many industries, and where the information provided has significant financial or safety implications many of these industries have implemented clear procedures not only for measurements but for quality control and assurance. Examples include Gold assay, where the purity of the gold established in the laboratory has a direct relationship to its price, medical laboratory analyses, where the data quality is literally a life and death issue and refrigerant viscosity (Ásale et al, 2000) where the device performance is crucially dependant on the fluid properties. There is increasing application of international standards for laboratory quality, particularly where the quality of the data reported is audited by an external, independent body for these businesses. In the oil industry, PVT laboratories provide data vital data and are often accreditation to international standards that are subjected to external audit, but the protocols relate to management systems and do not provide inputs or insights into the quality of data being generated – merely that procedures are written down and followed. Each laboratory develops its own experimental procedures, quality control procedures and establishes its own target quality limits. Whilst the individual laboratory may meet its own specifications routinely, in cases where the criteria are inadequate or insufficiently challenging, the result can be data that is sufficiently inaccurate as to have a material impact on the value of a project.

Value of PVT data

PVT laboratories generate data that is used in many applications throughout field life, including reservoir simulation, reserves submissions, facilities design, well bore and flow line dynamics, surveillance and fiscal allocation. The value of such data is best understood in relation to specific examples where the data did not meet minimum quality