AAPG International Conference
Barcelona, Spain
September 21-24, 2003

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An Evaluation of a Basin Modeling Involved Approach to Prospect Risk Analysis: Example Cases and a Methodology Comparison

The assessment of prospect risk can be linked with comprehensive petroleum systems analysis. This investigation evaluates a stochastic / thermal maturity modeling approach to prospect risk analysis that estimates risked reserves using a probabilistic, iterative simulation linked to a 1D thermal maturity modeling engine. The method simulates trap characteristics and hydrocarbon charge by means of calculated and Monte Carlo sampled probability distributions coupled with the probability of presence or absence (risk) of the essential petroleum system components.

A comparison of stochastic / thermal maturity vs. deterministic prospect risk analysis is examined, through the estimation of unrisked reserves. Deterministic treatment of source uncertainty (for example) is limited by inherent subjectivity and does not address generative potential. The key advantage of stochastic / thermal maturity modeling in contrast, is that it addresses the geological viability of the source itself, in addition to its uncertainty.

Comparison results indicate that trap characteristics calculate similarly and that each method may provide unrisked oil vs. gas reserves estimates. However, the stochastic / thermal maturity approach estimated greater liquids reserves based on modeled charge. Example cases are also presented of risked reserves estimates from stochastic / thermal maturity linked analysis. In one example, results indicate mean migrated gas and oil volumes of 4.8 Tcf and 2.0 B bbls. However, only 6.3% and 0.83%, respectively of these estimates are recoverable reserves. These results reflect the presence risk of trap and charge, modeled seal efficiency, and a structure with limited pore-volume.