ASSESSMENT OF THERMAL SOURING RISK FOR A TAGOGD FIELD DEVELOPMENT, OMAN

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A thermal EOR technique is planned to an oil field in Oman that contains very viscous oil in a fractured carbonate matrix. Conventional cold production alone will not maximize recovery of a significant proportion of in-situ volumes, so the application of Thermally Assisted Gas Oil Gravity Drainage (TA-GOGD) to the field is being evaluated. One concern about the use of TA-GOGD is the potential to produce H_2S, CO_2 and H_2 due to the increased of heat conduction from fracture to matrix resulting from steam injection. Knowledge of likely sour gas sources and concentrations at the field is vital for the selection of an economically, technically, and environmentally feasible field development project and so a steamflood impact study was launched. The results of this study will significantly impact surface design materials selection, sweet gas requirement for diluting the souring production, down-hole well design and optimization of the field life cycle.

In this presentation, we will demonstrate:

- our unique approach to the identification, isolation and quantification of sulfur forms and carbon species in rocks and fluids for characterization of sour gas sources,
- our unique system for thermochemical process simulation to quantify sour gas generation as a function of reaction conditions.

The outcome of this study allowed us to

- identify souring sources, their geological variations and mechanisms,
- estimate sour gas content and yield,
- develop a kinetics/PVT model to describe the impact of temperature on sour fluid generation, and
- provide critical kinetics input for reservoir simulation to forecast reservoir sour gas production and field development and thus to help select and qualify fit-for-purpose materials.

A summary of key results from the study is as follows:

- Reservoir and non-reservoir facies which could be impacted by heating were characterized, using analyses of sulfur sources for determination of H_2S souring potential and carbon sources for CO_2 generation potential.

- Completion of a series of aquathermolysis experiments, followed by integration of all the relevant experimental data, allowed us to successfully uncover the sources and yields of H_2S, CO_2 and H_2 from each of the three relevant geological facies.

- Elevated temperatures from 100°C to 280°C during steam injection will create variable risks for significant H_2S, CO_2 and H_2 generation from all three facies.

- A kinetics model that matches experimental data for the reservoir has been developed and an operating envelop for souring risk in the field has been defined as a function of steam injection.