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Shib Sankar Ganguli

Integrated Reservoir Studies for CO_2-Enhanced Oil Recovery and Sequestration

Application to an Indian Mature Oil Field

Doctoral Thesis accepted by
Academy of Scientific and Innovative Research

Springer

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Dedicated to my beloved parents

Thank you for instilling in me the virtues of perseverance and commitment and encouraging me to strive for excellence.

Supervisor's Foreword

It gives me immense pleasure to write the foreword of this excellent Ph.D. work. It is very widely accepted that CO_2 sequestration through enhanced oil recovery (EOR) can aid to climate change mitigation by reducing about 20% of CO_2 emission in the atmosphere. CO_2-EOR and sequestration is a cutting edge and imminent research in India, and there is an urgent need for the assessment of Indian hydrocarbon reservoirs for feasible CO_2-EOR and storage. This involves integrated reservoir studies such as reservoir flow modeling and simulation, rock physics, and seismic to recommend better cost-effective and technologically efficient CO_2-EOR and storage model, in particular for an Indian mature oil field.

Shib Sankar Ganguli was seriously involved in this joint Indo-Norwegian project funded by Norwegian Embassy in India and conducted his Ph.D. work in National Geophysical Research Institute, since 2011. One of the most challenging queries of this study was how to identify an Indian mature hydrocarbon field which would be feasible for CO_2-EOR followed by permanent storage, prior to its abandonment, with limited data provided by the operator. Moreover, as per the review by the operator, the studied field is not suitable for miscible CO_2 injection. In this view, I must admit that Shib has worked hard and come up with an outstanding scientific solution by developing a new injection scheme for miscible CO_2 displacement and better CO_2 EOR and storage model for Cambay Basin, India.

This work contributes significantly to the feasibility study of CO_2-EOR and sequestration in an Indian mature oil field for the first time in India with cross-disciplinary approach that combines the results from reservoir modeling and flow simulation, rock physics modeling, geomechanics, and time-lapse (4D) seismic monitoring study. The key findings of this work indicate that the field under study has great potential for EOR followed by CO_2 storage just after its economic abandonment. Just as certainly, I strongly believe this work is not only limited to

Indian mature oil fields, but also can be implemented anywhere in the world if justified properly with integrated approach. Moreover, this study provides a valuable resource and can be treated as a base work which can aid to better understanding of CO_2-EOR and storage in future. My heartiest congratulations go to Shib for this excellent piece of work.

Hyderabad, India
December 2016

Prof. V.P. Dimri

Parts of this thesis have been published in the following journal articles:

Ganguli, S. S., Vedanti, N., Akervoll, I., & Dimri, V. P. (2016a). Assessing the Feasibility of CO_2-Enhanced Oil Recovery and Storage in Mature Oil Field: A Case Study from Cambay Basin. *Jour. of Geol. Soc. of India*, *88*(3), 273–280.
Ganguli, S. S., Vedanti, N., & Dimri, V. P. (2016b). 4D reservoir characterization using well log data for feasible CO_2-enhanced oil recovery at Ankleshwar, Cambay Basin-a rock physics diagnostic and modelling approach. *Jour. of Applied Geophy.*, *135*, 111–121.

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