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Reservoir Simulation Studies to Assess Sequestration Potential in New Zealand Oil and Gas Fields

Rosalind Archer¹, Malcolm Arnot², Karen Higgs², Brennan Williams³

¹University of Auckland, Auckland, New Zealand

²GNS Science, Wellington, New Zealand

³Geovisual Limited, Auckland, New Zealand

Depleted oil and gas fields are being considered world wide as potential locations to sequester CO₂. The use of CO₂ for enhanced oil recovery (EOR) is also a potentially important strategy. This paper reviews simulation studies made of two New Zealand petroleum reservoirs. The first study is of EOR potential Cheal field. Operations in this field are challenging because of the waxy nature of the oil. A reservoir simulation model of this field was constructed using data provided by Austral Pacific Energy Limited who operate the field. The model shows that the injected carbon dioxide is able to achieve some miscibility with the in-situ oil. Well productivity is enhanced by the injection which naturally boosts reservoir pressure. In the base case simulation estimated ultimate recovery of the medium and heavy components of the oil is increased by approximately 65%, while there is some loss in the estimated ultimate recovery of lighter hydrocarbon components. Sensitivity cases run with this model highlight the importance of key variables including compositional and thermal effects related to wax deposition from this oil.

The second field study completed in this project addressed the sequestration potential of the Maui field. This field is a large field producing gas/condensate and oil offshore from Taranaki (New Zealand). Production from the field started in 1979 and the field is now in decline. The reservoir simulation model of this field was built from public domain data and only addressed CO₂ storage (i.e. it did not include an enhanced recovery phase). Production is from two sands - the *C* and *D* sands - and is also divided into the Maui A and B accumulations. The scale of this field, which has to date produced over 3 Tscf of gas and 146 MMbbls of oil, means that the model developed in this study highlights the interaction which occurs between neighbouring sands and accumulations as CO₂ injection proceeds.

Both simulation studies highlight key reservoir characterization steps and uncertainty assessment considerations relevant to any reservoir simulation study of a CO₂ sequestration process in an oil/gas field.