

Paper Number14440-PA

10.2118/14440-PA

TitleRadioactive Tracers Monitor Solvent Spreading in Rainbow Vertical Hydrocarbon Miscible Flood

AuthorsMcIntyre, F.J., Canterra Energy Ltd.; Polkowski, G.A., Canterra Energy Ltd.; Bron, J., Bron and Assocs.; Pow, M.J., Canterra Energy Ltd.

JournalSPE Reservoir Engineering

VolumeVolume 3, Number 1

DateFebruary 1988

Pages273-280

Copyright1988. Society of Petroleum Engineers

PreviewSummary

This paper describes the design, implementation, and results of a tracer project. Three different radioactive tracers (tritiated methane, ethane, and butane) were used to monitor the initial phase of solvent spreading. As a result, adjustments were made to the distribution of injected solvent, ensuring the placement of a stable solvent bank.

Introduction

Radioactive tracers were successfully used to ensure the proper placement of a gravity-stable solvent bank in a tertiary vertical placement of a gravity-stable solvent bank in a tertiary vertical hydrocarbon miscible flood in the Rainbow Keg River B pool, Alberta, Canada.

In the south lobe of Rainbow Keg River B pool, six injection wells are being used to place the solvent at the reef top. Three tritiated hydrocarbons were chosen to tag the injected solvent to monitor the initial phase of solvent spreading.

This paper describes the design, implementation, and results of the tracer project. The design section shows the calculation of the amount of required tracer injection, the locations of tracer placement, and the design of the sampling program. The placement, and the design of the sampling program. The implementation section shows the method of tracer injection, production stream sampling, and laboratory analysis.

After 30 months, tracers have been detected at 16 of the 18 producing wells in the south lobe of the B pool. This has helped producing wells in the south lobe of the B pool. This has helped to identify channeling and to determine areal solvent distribution. Remedial action has been taken in the field to improve solvent areal spreading and to reduce channeling to obtain a gravity-stable solvent bank.

This paper presents a novel laboratory method that reduces the detection limit of radioactive tracers to a concentration of 80 Bq/std ml [60×10^{-12} Ci/scf] in the produced fluids. The success of this method has been confirmed with field results.

It also shows how to design a tracer program to monitor placement of a gravity-stable solvent bank, placement of a gravity-stable solvent bank, Geology, Petrophysics, and Fluid Properties. The Rainbow Keg River B pool is the largest oil-bearing reef in the

Rainbow, field, with 44 x 106 stock-tank M3 [276 x 106 STB] of original oil in place (OOIP). It was discovered in 1965 and is located in place (OOIP). It was discovered in 1965 and is located in Alberta, Canada. 664 km [415 miles] northwest of Edmonton (Fig. 1).

Geologically, it is ascribed to the Rainbow reefal development (Fig. 2). Hydrocarbon production is obtained from the middle Devonian Upper Keg River formation (Rainbow member) at a depth of about 1800 m [5,905 ft].

The Rainbow Keg River B pool is an atoll-type reef, having two structural lobes (north lobe and south lobe) separated by a saddle oriented east/west (Fig. 3). The original oil/water contact (OWC) was found at 13807 m [45,280 ft] subsea, with about 10 m [328 ft] of gross oil pay between the OWC and the reef top. Three petrographic/petrophysical zones (Zones A, B, and C) have been distinguished within the reservoir. Zone A consists of deposits of shallow upper-shoal environment and the top part of shallow lower-shoal environment, and has good rock properties ($\phi = 10$ to 30%, $k_{max} = 10$ md to very large). Zone B consists of deposits of shallow upper-shoal, shallow lower-shoal, and transition zones. Both good and poor rock properties are present in Zone B ($\phi = 7$ to 10%, $k_{max} = 10$ md to very large). Zone C consists predominantly of reefal development and has the best rock properties ($\phi = 10$ to 30%, $k_{max} = 5$ md to thousands). A vugular system created by dissolution is found mainly in the upper lagoonal sediments and is partially plugged by calcareous cement and pyrobitumen. A fracture partially plugged by calcareous cement and pyrobitumen. A fracture system, created by the orogenic movements of the Rocky Mountains, is oriented northeast/southwest, improving permeability in this direction.

Number of Pages 8