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A Comprehensive Study on Mineral Scaling Potential during Water Flooding in an Offshore Oilfield

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Summary

The study evaluates the risk of mineral scaling potential occurring during water injection in an offshore oilfield through detailed water compatibility and scaling analysis.

Methodology

The objective of this study was to assess the risk of mineral scaling which might occur during water injection in an offshore oilfield. Several formation water samples from the field were collected through DST testing. These samples were analyzed in order to determine their mineral scaling potential and their mixture compatibility with sea water used as injection water during field development. The formation water samples mixed with sea water were tested in 323 bars pressure, 40-109 ^{o}C temperature, and different mixing fractions. Then a detailed water compatibility and scaling study was performed to investigate the scaling that might occur during the planned field water injection scheme. Scale formation predictions are based on thermodynamics and chemical laws. Scaling in an injector due to incompatibility of waters is considered minor and temporary. The surface contact between the two waters is very restricted and thus little mixing will take place.

Results and Conclusions

In the case of producing wells, scaling may be severe when injection water breakthrough occurs. In fact, there will be considerable mixing of two waters, and as the proportion of injection water increases, the amount of scale will also increase. The study based on the collected samples has showed no risk of scaling for barium, strontium and calcium sulfate but a potential risk of scaling for calcium carbonate. A classical scaling problem, when injecting sea water, could be encountered if the cooling effect in downhole injector conditions is not enough. This can be the case since the start of water injection. This scaling problem can be solved by injecting scaling inhibitor during this injection phase, if necessary. Additional scaling problem due to calcium carbonate may be encountered after sea water breakthrough in the producer and will be solved by squeezing scale inhibitors in the producers, if necessary.

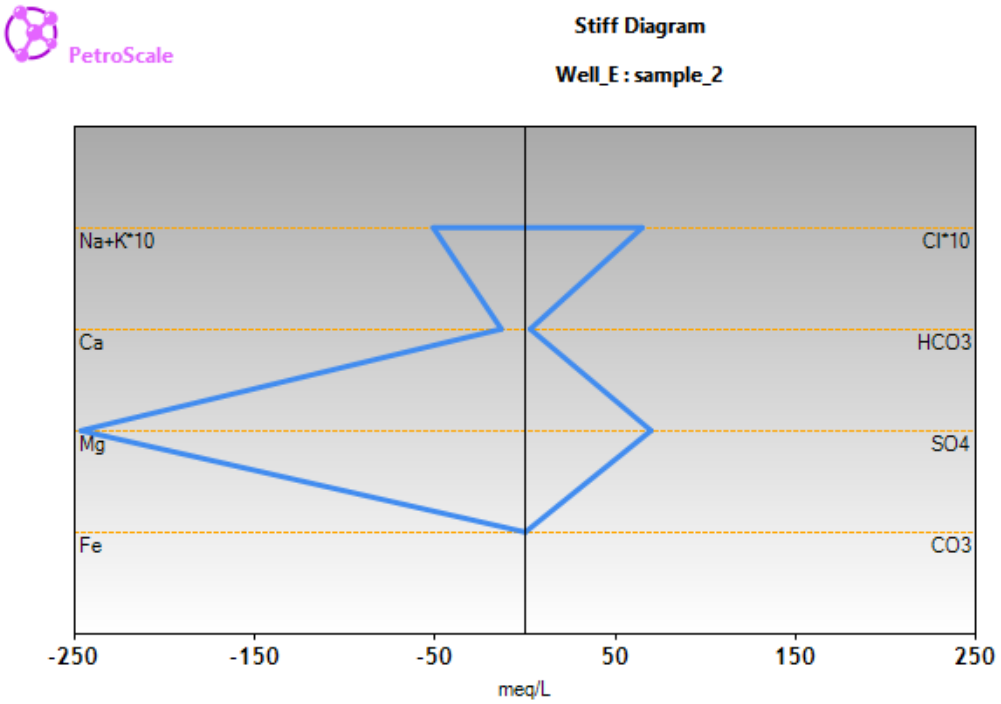

Figure 1. Stiff diagram for one the water samples.

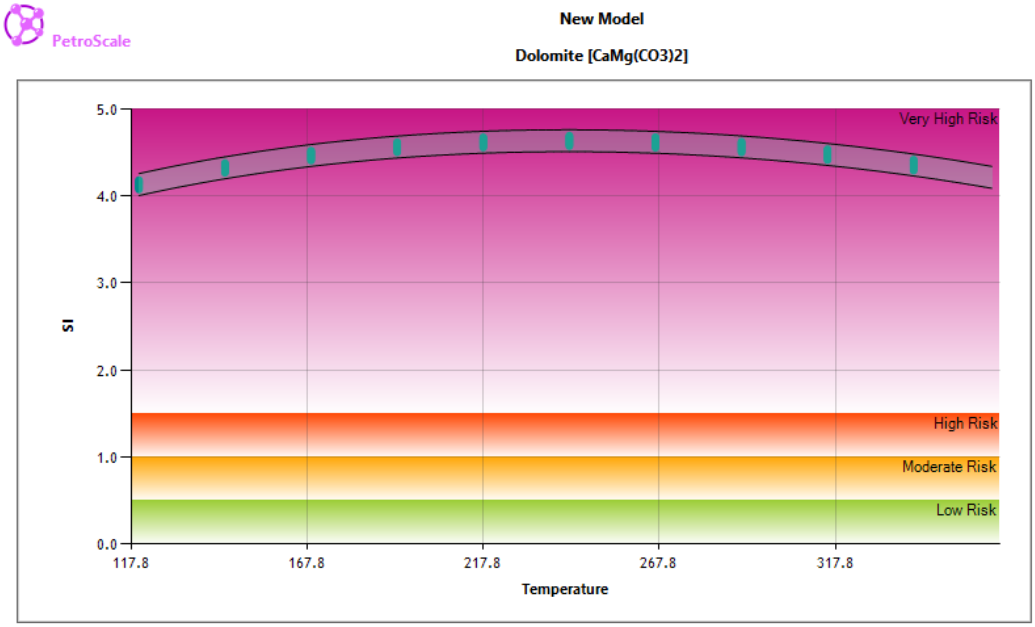

Figure 2. Saturation index versus temperature for dolomite scaling demonstrating the potential risk of scaling

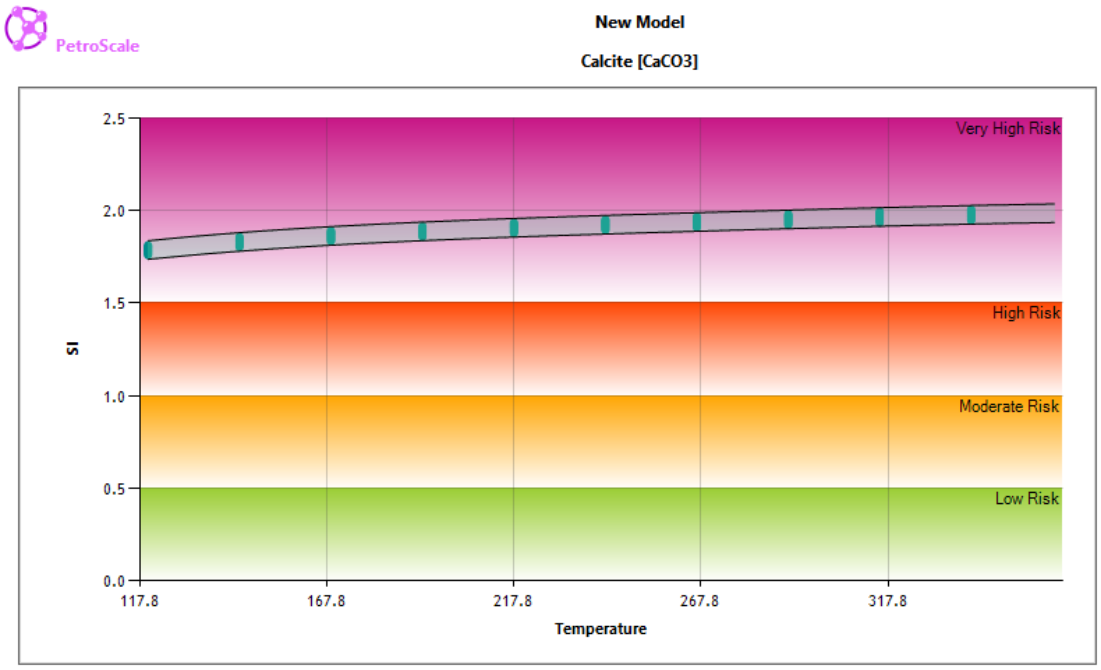

Figure 3. Saturation index versus temperature for calcite scaling demonstrating the potential risk of scaling