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# Correcting for Mud Filtrate Contamination of Formation Water Samples for Scale Management Planning: A Case Study from the Nova Field, Norwegian North Sea

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## Abstract

To develop scale management strategies and plans during field development planning, it is important to know the composition of formation water in the reservoir. Typically, formation water samples will be collected from appraisal wells and analysed for this purpose. However, when the wells are drilled with water-based mud, the samples are often contaminated with mud filtrate that has invaded the formation during drilling. By adding a tracer to the drilling mud and using a simple mass balance correction technique, it is possible to correct for the effects of contamination and obtain an estimate of the formation water composition. But, where reactions occur during invasion or within the sample after collection, this method of correction will generate an erroneous estimate of the composition. The errors will increase with the extent of reaction and degree of contamination.

In this paper, we describe a new 'correction' approach which additionally makes use of (a) 1-D reactive transport modelling of mud filtrate invasion and (b) modelling of reactions occurring in formation water samples after collection. This approach accounts for the potential effects of these reactions and provides an estimate of the formation water composition within uncertainty limits. It reduces the risk of obtaining erroneous estimates of formation water composition and is particularly beneficial where reactions occur and where the mud contamination fractions are elevated (e.g. ~10-40%). At higher fractions, the uncertainties can be so high that the estimated compositions are not useful, emphasising the risks of trying to estimate formation water compositions from heavily contaminated samples.

This approach has been applied to formation water samples obtained from the Nova Field (formerly Skarfjell, Norwegian North Sea). It has meant that the resulting composition and associated uncertainties have been used with more confidence in scale management planning; to select seawater as the injection water, and to identify the scale risks across the relevant nodes in the production process over the life of field of the asset. Based on these risks, appropriate scale mitigation and monitoring measures have been selected.