Oilfield Scale-Induced Permeability Damage Management During Waterflooding

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Abstract

The precipitation, accumulation and disposition process of oilfield sulphate scales is a major ongoing flow assurance problem in hydrocarbon production. This pose serious injectivity and productivity problems in a water flooded reservoirs.

Several works and software packages such as multi-scale 6.0 and scalechem have been developed for predicting scaling tendency and average scalesprecipitation inside the reservoir but neglecting the fact that not all the occurring scale precipitation would cause formation damage near the well bore region. Some of the precipitated scales escape through the pore spaces to render havoc to flow in the production string since it is not all the scale precipitation inside the reservoir would plug the formation.

For an adequate planning and monitoring of water injection, scale treatment schedule and disposition programme, there is the need to estimate the fraction of sulphate scales precipitation that occupies pore spaces and the corresponding degree of permeability damage at well bore vicinity. It is also imperative to evaluate the effects of oilfield scale induced permeability damage on the success of water flooding project.

In this paper, an interactive software package has been developed for predicting the fraction of oilfield scales that occupies pore space and the corresponding permeability damage at different location away from the well bore. The software complement the existing oilfield scaling prediction software such as multi-scale 6.0, scalechem and scalbute recently reported by Fadairo et al. This is useful for adequate planning and controlling of water injection project, oilfield scale treatment schedule and disposition programme.

Introduction

Oilfield scale induced formation damage is one of the difficult and profit hurting phenomenon that occur during water flooding project. The prediction and prevention requires description and classification of mixing, precipitation1, buildup, and formation damage scenarios2-7. Mixing of incompatible waters takes place in the water-contacted portion of the reservoir during flooding1-8. The accumulation of precipitates does not occur as a result of mixing zone movement and the precipitate deposited at a point in the reservoir during mixing zone movement does not cause significant permeability reduction2-6. Even-though, scales do cause formation damage in the near well region its effect is less significant outside the vicinity of the well bore5-7.

Oilfield scale induced formation damage phenomenon is as a result of precipitation and accumulation of inorganic sulphate scale around the well bore after the water breakthrough at reduced reservoir pressure7-8. This may influence reservoir performance, well bore performance and deliverability of the reservoir system10. The operational parameters, wellbore/reservoir properties and even the fluid properties that influence the magnitude of flow impairment by oilfield scales can be easily tour with, to manage and drastically reduced formation damage.

A variety of solubility models have been studied that are suitable for predicting scaling of minerals commonly found in oil reservoir. The available models for scale prediction are based on thermodynamics, kinetics and solubility data to estimate only the scaling tendency and precipitation in the mixing portion of the reservoir.

Studies1-6 has shown that not all the oilfield scale precipitation that occurs inside the reservoir will cause formation damage or injectivity loss around the well bore region. Some of the precipitation will be captured within the pore spaces at different radial distances from the well bore vicinity due to pressure drawdown while the remaining will escape through the pore space into production string.

The SEG Wiki is a useful collection of information for working geophysicists, educators, and students in the field of geophysics. The initial content has been derived from : Robert E. Sheriff's Encyclopedic Dictionary of Applied Geophysics, fourth edition.