Removal and By-Pass of Condensate Banking or Retrograde Condensate Saturation

Summary

Condensate that precipitates in the near wellbore pores by a gas that passes through the dew point as it nears the wellbore reduces the permeability to gas through relative permeability effects. The damage produced by condensate in the pores is a type of time dependent skin damage. Skins from condensates are on the order of 1 to over 20. These skins may remain very low until the gas reaches the dew point and then the skins may rapidly increase.

There are few wellbore-based treating options that can reduce the effects of condensate saturation in the near well sufficiently to improve flow, and none of these options has proven to have a long-term effect.

Reperforating the wellbore may have a short-term effect provided the current shot density is less than about 8 shots per foot and less than 60 degree phasing. Perforation depths are usually about 6 to 12 inches in reservoir rocks. The short depth does not allow for adequate reservoir contact to offset even shallow skins of 20+. Although new perforations will improve inflow where damage is concerned, the amount of skin damage reduction is usually only a point of two, except where layered reservoirs have not been fully accessed or if the damage is still shallow or localized in a high permeability streak. Reperforating in Amoco's Anschutz field was less than spectacular in condensate by-pass attempts, although some gains were noticed (Anschutz Nugget formation was a largely block sand). .

Amoco experimented with methanol and other short-chained alcohol injection in the Anschutz Ranch field and some other fields with retrograde behavior in the 1990's to try to resolubilize the condensate. Although skins were often cut by 30 to 50%, the damage was never removed. The effects of the treatments did not last more than a few weeks. (See also SPE 62935)

Dry gas injection (condensate revaporization) was explored by Amoco (SPE 1813, March 1969, JPT) and others (CIM:1967, AIME 1948, SPE 68170, etc.) for over 50 years. The process will work on a small scale, but usually requires cycling of the wells and significant investment in compression and pumps.

Gas cycling can be effective, but requires a different operating procedure and commitment (O'Dell, et.al., JPT, 1967). The quantity of gas needed depends on the heaviest retrograde component. The speed of revaporization can also be affected by the composition of the dry gas.

Amoco tried nitrogen injection into wells in the Anschutz Ranch field in the 1980's to drive condensate back. The effect was small and very short lived. The field wide pressurization with Nitrogen was successful. Several efforts have been pushed forward on this front and Nitrogen and dry gas injection has been compared (SPE22360).

Increasing reservoir contact seems to be one of the best ways to offset the condensate precipitation effects on permeability. Both horizontal wells (SPE 54351) and hydraulic fracturing (are viable solutions to the problem. Hydraulic fracturing was successfully done in many cases world wide by Amoco, to offset the skin damage caused by retrograde condensate. Neither horizontals nor fractures will prevent condensate drop out. The purpose is simply to offer more flow area and reduce the effect of the skin damage in radial flow. In examining the condensate banking/retrograde solutions, enlarging the wellbore has had better long-term performance.