

## Relative Perm Effects: Oils in Gas Reservoirs

The question of placing oil in a gas reservoir always goes back to the potential relative permeability problem. Literally, the effect of an oil on gas permeability can be harmful or not, depending on the oil and the formation pore size, pressure and permeability.

There are a few experiences that address this concern:

1. If a diesel is ultimately used for any purpose in a gas well, make sure that the diesel is #1 or artie diesel or filter it. Do not use #2, marine diesel, or bunker C oil under any circumstances. The problem is two fold: physical pore throat plugging from the solids in #2 grade of diesel (paraffins and other organics) and gellation of the paraffins in the diesel at cooler temperatures. These paraffin crystals serve as sites for advanced wax growth so remove it. #2 diesel is even damaging when used in an oil reservoir although the damage is generally slowly removed by oil flow. If used in a gas reservoir, the damage from # 2 diesel would be long lasting.
2. Clean diesel (filtered to 2 to 5 microns through a filter with a beta rating of 1000), may cause some formation damage in a gas reservoir, depending on permeability. The low permeability formations (less than 20 md) may be the most severely affected since the pores are smaller and the wetting layer of diesel will produce the highest impact on permeability. In higher permeability formations, particularly over 100 md, you will see some damage but it will clean up with time if the gas has any condensate. I base my projection on the use of light oils used in Canada to fracture gas wells. Damage is very slight after a few weeks production. Oil based mud is used to drill gas wells in many areas with minimum damage. The damage is slight as long as the mud is cleaned up with a dispersing solvent. If damage persists, it can be removed by a light solvent (xylene mix or suitable alternative) wash of 5 to 10 gal per ft.
3. There are surfactants that can be included in the clean diesel to minimize the damage from a wetting layer. These are materials that lower the adsorption of oil in water or gas zones. Dowell freeflo D was an additive from 15 years ago that we used successfully when removing water blocks from oil wells. There may be similar chemicals available for oil use in gas wells.

In my opinion, the biggest hurdle that you have is keeping everyone aware that clean diesel is required. Most operators see diesel on the procedure and grab the first material available - this will definitely produce damage. I'd put a requirement on this to filter any fluid to be used through 2 to 5 micron pod or DE filters that have a beta rating of at least 1000. (The beta rating of 1000 means that for every 1000 particles in the dirty fluid, only 1 particle comes through in the same volume of clean fluid).

We've also used the clean diesel with 10% xylene added to stabilize paraffins that are contained in any oils that are in the well system. This works very well and cleans up rapidly, but watch the effect of the aromatic (xylene) on your seals.