Reservoarfluider og Strømning
Reservoir Fluids and Flow
Course TPG 4145

Problem 2 –
"Gas Condenate (fluid)" Problem

Handed Out: Sept. 13, 2011
Due Date: Sept. 27 midnight

Based on the calculated results for the "gas condensate" fluid in Table 2.1 using the Soave-Redlich-Kwong (SRK) equation of state (EOS) in PhazeComp – given in Problem2-GasCond.out:

1. Plot the p-T diagram including the labeling (in green) of the bubblepoint line, (in red) the dewpoint line, and (in black) an open circle with the critical point (or your best estimate of that point).

2. Assume the reservoir fluid fills the production tubing in a well during an initial shut-in, where surface temperature is 5^oC and a linear temperature variation exists down to reservoir temperature of 150^oC. Assume the entire tubing has the reservoir fluid as a static single phase, but the fluid at the top of the tubing is saturated. (a) What is the reservoir pressure? (b) What depth does the fluid change change from a bubblepoint-to-dewpoint condition? Assume fluid density is constant from top to bottom of the tubing. Plot on a "copy" of the figure from question 1, pressure-temperature points along the static fluid column, marking the "gas-oil contact".

3. Now assume that the reservoir pressure has depleted 10 bar after some production – 10 bar lower than you calculated in question (2). Estimate during a new shut-in condition: (a) the approximate location of the gas-oil interface in the tubing, and (b) the surface pressure. State your assumptions; e.g. that gas density is constant in the top of the tubing, and oil density is constant below the gas-oil contact in the tubing.

4. Calculate the OGR in $Sm^3/1E6Sm^3$ assuming an expensive surface process is installed with 100% surface-oil recovery of all components C_{4+}, with all lighter components C_{3-} forming surface gas. Express also in STB/MMscf. Calculate the surface oil (C_{4+}) density/molecular weight ratio using liquid densities given for components in Appendix A.

5. Calculate the component ***surface*** oil recovery factors ($RF_{oi}=n_{oi}/n_i$) for C_1, C_2, C_3, C_4, C_5, C_6, and C_{7+} for the 2-stage surface process used in PhazeComp. Plot as RF_{oi} vs name *i*.

6. What percentage of the operator's sales revenue comes from surface oil if oil price is \$115/STB and gas price is \$3.5/Mscf, assuming the same government royalties for oil and gas? Use the two-stage surface processing from PhazeComp calculations.

7. Answer same question (6) but assuming a reservoir temperature of 100^oC (instead of 150^oC), where government royalties for an "oil field" are 80% for oil and 30% on gas.

8. Plot on log-log scale the K-values of C_1, CO_2, C_3, C_7, C_{7+} and C_{30+} vs pressure, for 100^oC from the saturation pressure down to 0.01 bara. Estimate, by graphical extrapolation, the convergence pressure p_k where K-values approach 1. Identify the vapor pressure of C_7 and plot as a solid circle symbol at $K_{C7}=1$. On the same figure, plot the modified-Wilson equation K-value for C_7 and compare with the EOS model; you must assume a convergence pressure and A_2 (e.g. =0.7, or a best-fit value that you determine gives a best fit of the EOS-calculated K-values).

Turn your solution into ItsLearning, with a *single* xls file for grading, with one sheet for each question above. Use comments and annotations in your file to show clearly what you have done. Use the following naming convention:

TPG4145-Problem2-FirstName(LastName).xls

Wrong file naming convention, no grade!

No group solutions (though you can work together on the tougher questions), everyone hands in their own solution!