Material Balance OOIP

$$N=\frac{N_pB_o+(G_p-N_pR_s)\,B_g+(W_p-W_i-W_e)\,B_w-G_iB_g}{(B_o-B_{oi})+(R_{si}-R_s)\,B_g+mB_{oi}\left(\frac{B_g-B_{gi}}{B_{gi}}\right)+\left(\frac{B_{oi}}{1-S_w}\right)(1+m)\,(S_wC_w+C_f)\,(P_{ri}-P_r)}$$

This formula considers all factors that could impact the calculation of OOIP. In this study, it is assumed that there is no water influx (W_e), water injection (W_i), or gas injection (G_i). Therefore, those terms are zero and the formula reduces to

$$N=\frac{N_pB_o+(G_p-N_pR_s)\,B_g+W_pB_w}{(B_o-B_{oi})+(R_{si}-R_s)\,B_g+mB_{oi}\left(\frac{B_g-B_{gi}}{B_{gi}}\right)+\left(\frac{B_{oi}}{1-S_w}\right)(1+m)\,(S_wC_w+C_f)\,(P_{ri}-P_r)}$$

Above the bubble point, the solution gas/oil ratio (R_s) does not change with pressure. Therefore, $R_{si} - R_s = \emptyset$. There is no gas cap above the bubble point, so the ratio of gas cap pore volume to oil zone pore volume (m) is also zero. Finally, there is no free gas, so the term $(G_p - N_pR_s) = \emptyset$. Therefore, above the bubble point, the resultant equation is

$$N = \frac{N_pB_o - W_pB_w}{(B_o - B_{oi}) + \left(\frac{B_{oi}}{1 - S_w}\right)(S_wC_w + C_f)\,(P_{ri} - P_r)}$$

Below the bubble point, the effects of the expansion of rock and water becomes negligible and is, therefore, usually excluded. The formula utilized follows.

$$N = \frac{N_pB_o + (G_p - N_pR_s)\,B_g + W_pB_w}{(B_o - B_{oi}) + (R_{si} - R_s)\,B_g + m\left(\frac{B_g - B_{gi}}{B_{gi}}\right)}$$

Terms

Definitions of the individual terms are listed in Attachment 1. The combined terms are defined below.

N_pB_o = cumulative oil produced, *RB*

$(G_p-N_pR_s)\ B_g$ = cumulative free gas produced, *RB*

W_pB_w = cumulative water produced, *RB*

(B_o-B_{oi}) = oil expansion, *RB/STB*

$(R_{si}-R_s)\ B_g$ = free gas expansion, *RB/STB*

$mB_{oi}\ (B_g-B_{gi})/B_{gi}$ = gas cap expansion, *RB/STB*

$(B_{oi}/(1-S_w))\,(1+m)\,(S_wC_w+C_f)\,(P_{ri}-P_r)$ =
rock and water expansion, *RB/STB*

BEFORE THE
OIL CONSERVATION DIVISION
Santa Fe, New Mexico

Case No. 11724 Exhibit No. 19

Submitted by: Hanley Petroleum Inc.
and Yates Petroleum Corporation

Hearing Date: May 15, 1997