

Slightly compressible Material Balance Pressure @model

Approximation of [Material Balance Pressure @model](#) for [slightly compressibility flow](#):

(1)	$p(t) = p_i + \frac{\Delta Q(t)}{V_\phi \cdot c_t}$
(2)	$\Delta Q = -\frac{B_o - R_s B_g}{1 - R_s R_v} \cdot Q_O^\uparrow + \frac{B_g - R_v B_o}{1 - R_s R_v} \cdot (Q_G^\downarrow - Q_G^\uparrow + Q_{GAP}^\downarrow) + B_w (Q_W^\downarrow - Q_W^\uparrow + Q_{WAG}^\downarrow)$

where

$\Delta Q(t)$	Cumulative Voidage Replacement Balance (CVRB) over time t
$V_\phi = V \cdot \phi_i$	initial drainage volume of the main pay (excluding the aquifer and gas cap)
$\phi_i = \phi(p_i)$	initial porosity
$c_t = c_\phi + c_o s_{oi} + c_g s_{gi} + c_w s_{wi}$	total compressibility
c_ϕ	pore compressibility
s_{wi}	initial water saturation
s_{gi}	initial gas saturation
s_{oi}	initial oil saturation : $s_{oi} = 1 - s_{wi} - s_{gi}$
c_o, c_g, c_w	fluid compressibility of water phase, oil phase and gas phase

The equations (1) and (2) are often used in express assessment of thief water production share $\Omega_W^\uparrow = Q_{W,true}^\uparrow / Q_W^\uparrow$ and thief water injection share $\Omega_W^\downarrow = Q_{W,true}^\downarrow / Q_W^\downarrow$:

(3)	$p_i - p(t) = \alpha \cdot Q_O^\uparrow(t) + \beta \cdot Q_W^\uparrow(t) - \gamma \cdot Q_W^\downarrow(t)$	(4)	$\alpha > 0, \quad \beta > 0, \quad \gamma > 0$		
(5)	$V_\phi = \frac{1}{\alpha \cdot c_t} \cdot \frac{B_o - R_s B_g}{1 - R_s R_v}$	(6)	$\Omega_W^\uparrow = \frac{Q_{W,true}^\uparrow}{Q_W^\uparrow} = \frac{\beta}{\alpha} \cdot \frac{1}{B_w} \cdot \frac{B_o - R_s B_g}{1 - R_s R_v}$	(7)	$\Omega_W^\downarrow = \frac{Q_{W,true}^\downarrow}{Q_W^\downarrow} = \frac{\gamma}{\alpha} \cdot \frac{1}{B_w} \cdot \frac{B_o - R_s B_g}{1 - R_s R_v}$

See Also

[Petroleum Industry / Upstream / Production / Subsurface Production / Field Study & Modelling / Production Analysis / Material Balance Analysis \(MatBal\) / Material Balance Pressure @model](#)

[[Derivation of Slightly compressible Material Balance Pressure @model](#)]

[[Capacitance-Resistivity Model \(CRM\) @model](#)]