

Cumulative offtakes (withdrawals)

Cumulative production of all [reservoir fluids](#) to the surface from the beginning of production t_0 until current moment of time t adjusted to [reservoir](#) conditions:

(1)
$$Q_i^\uparrow(t) = \int_{t_0}^t q_i^\uparrow(\tau) d\tau$$

where

$q_i^\uparrow(\tau)$	instantaneous offtakes at time moment τ
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For the [volatile oil fluid model](#) the [cumulative offtakes](#) is related to [surface flowrates](#) history of [fluid components](#) as:

(2)
$$Q_i^\uparrow(t) = \int_{t_0}^t \left[B_w q_W^\uparrow + \frac{B_o - R_v B_g}{1 - R_v R_s} q_O^\uparrow + \frac{B_g - R_s B_o}{1 - R_v R_s} q_G^\uparrow \right] d\tau$$

where

$q_W^\uparrow(\tau), q_O^\uparrow(\tau), q_G^\uparrow(\tau)$	water, oil, gas surface flowrates at time moment τ
$p_e(\tau), T_e(\tau)$	formation pressure and formation temperature at time moment τ
$B_w(p_e, T_e), B_o(p_e, T_e), B_g(p_e, T_e)$	formation volume factors between separator and sandface pressure/temperature conditions
$R_s(p_e, T_e), R_v(p_e, T_e)$	Solution GOR and Vaporized oil ratio at sandface pressure/temperature conditions

The difference between [cumulative offtakes](#) and [cumulative production](#) is that [cumulative offtakes](#) recalculates produced [surface volumes](#) to [sandface](#) conditions and accounts for the [shrinkage factors](#) and [cross-phase exchange coefficients](#) dependence on [formation pressure](#) $p_e(t)$ and [formation temperature](#) $T_e(\tau)$ which may vary over time:

Cumulative offtakes (no reference to the fluid)	Cumulative production (no reference to the fluid)
$Q_{\text{off}}^\uparrow = \int_0^t B(p_e(\tau), T_e(\tau)) q^\uparrow(\tau) d\tau$	$Q_p^\uparrow = \int_0^t q^\uparrow(\tau) d\tau$

See Also

[Petroleum Industry](#) / [Upstream](#) / [Production](#) / [Subsurface Production](#) / [Field Study & Modelling](#) / [Production Analysis](#)

[[Offtakes](#)] [[Cumulative Intakes](#)] [[Cumulative VRR](#)] [[Cumulative Production](#)]