Assumptions made for Calculations for Liquid Recoveries

1. Q is averaged at a constant rate.

2. P_f is formation flowing pressure at a constant rate.

3. Formation flow is taken as single phase flow.
   If gas is produced at surface, phase separation is assumed to have occurred in drill pipe.

4. Radial flow is assumed.

5. For the purpose of calculating EDR where specific reservoir parameters are not available it is assumed that:

   Effective permeability, K, will fall between .... 1 to 200 md
   Formation porosity, ϕ, will fall between .... 0.1 to 0.3
   Fluid compressibility, c, will fall between .... 10^{-6} to 10^{-4}
   Fluid viscosity, μ, will fall between .... 0.05 to 50 cp.
   Well bore radius, r_w, will fall between .... $3\frac{7}{8}$" to $4\frac{3}{8}$"

   Which gives an average value for the function log $\dfrac{K}{\phi\mu cr_w^2}$ of 5.5

6. Other standard radial flow, equilibrium assumptions.

Empirical Equations:

1. $EDR = \dfrac{P_o - P_f}{M(\log T + 2.65)}$ where $M = \dfrac{P_1 - P_{10}}{\text{Log Cycle}}$

2. Transmissibility $\dfrac{Kh}{\mu\beta} = \dfrac{162.6\,Q}{M}$

3. DST $J = \dfrac{Q}{P_o - P_f}$ Theoretical $J = \dfrac{7.08 \times 10^{-3}\,Kh}{\mu\beta \ln(r_e/r_w)}$ Assumed $\ln(r_e/r_w) = 7.60$

4. $\text{P.S.} = \left[P_o \times 2.309 \text{ ft./PSI} \right] - \left[\text{Recorder depth to sea level.} \right]$

5. Radius of investigation, $r_i \cong \sqrt{\dfrac{Kt}{40\phi\mu c}}$ where t = time in days

Symbols		Dimensions	Symbols		Dimensions
β	Formation volume factor	vol./vol.	Q_o	Rate of oil flow during test	Bbls./day
c	Fluid compressibility	vol./vol./psi	Q_w	Rate of water flow during test	Bbls./day
EDR	Estimated damage ratio		Q_g	Rate of gas flow during test	MCF/day
ϕ	Formation porosity	fractional	r_e	External Boundary Radius	feet
h	Net producing interval	feet	r_i	Radius of investigation	feet
J	Productivity index (P.I.)	Bbls./day/PSI	r_w	Well bore radius	inches
K	Permeability	Millidarcies	S_w	Water saturation	%
M	Slope of shut-in build up	PSI/log cycle	t	Shut-in time period	minutes
P_f	Final flowing pressure	PSIG	Δt	Increment time of shut-in period	minutes
P_{fsi}	Final shut-in pressure at time t	PSIG	T	Open flow time period	minutes
P_{isi}	Initial shut-in pressure	PSIG	$^\circ T_f$	Formation temperature	$^\circ$Rankin
P_o	Maximum reservoir pressure	PSIG	μ	Fluid viscosity	
P_1	Final shut-in build up plot intercept @ 1	PSIG		(Reservoir Conditions)	Centipoise
P_{10}	Final shut-in build up plot intercept @ 10	PSIG	Z	Gas deviation factor (compressibility factor)	
P.S.	Potentiometric surface	feet	$\dfrac{Kh}{\mu\beta}$ or $\dfrac{Kh}{\mu}$ Transmissibility factor		$\dfrac{\text{Md.} - \text{ft.}}{\text{Cp.}}$
Q	Rate of flow during test	Bbls./day			