**Pressure Analysis**

**Gas Expansion Equations**

Basic gas laws :

*P1 V1 ÷ T1 = P2 V2 ÷ T2*

Where ;

P1 = formation pressure (psi)  
P2 = hydrostatic pressure at the surface or any depth in the wellbore (psi)

V1 = original pit gain (bbl)  
V2 = gas volume at surface or at any depth of interest (bbl)

T1 = temperature of formation fluid, degrees Rankine (0R = °F + 460)  
T2 = temperature at surface or at any depth of interest, degrees Rankine

Basic gas law plus compressibility factor

*P1 V1 ÷ T1 Z1 = P2 V2 : T2 Z2*

Where Z1 = compressibility factor under pressure in formation,dimensionless  
 Z2 = compressibility factor at the surface or at any depth of

interest, dimensionless

Shortened gas expansion equation :

*P1 V1 = P2 V2*

Where ;

P1 = formation pressure (psi)  
P2 = hydrostatic pressure plus atmospheric pressure (14.7 psi), psi  
V1 = original pit gain (bbl)  
V2 = gas volume at surface or at any depth of interest (bbl)

**Hydrostatic Pressure Exerted by Each Barrel of Mud in the Casing**

With pipe in the wellbore :

Sample Case : Dh — 9-5/8 in. casing — 43.5 lb/ft = 8.755 in. ID  
 Dp = 5.0 in. OD  
 Mud weight = 10.5 ppg

With no pipe in the wellbore :

Sample Case : Dh — 9-5/8 in. casing — 43.5 lb/ft = 8.755 in. ID  
 Mud weight = 10.5 ppg

**Surface Pressure During Drill Stem Tests**

Determine formation pressure :

*Psi = formation pressure equivalent mud wt. (ppg) x 0.052 x TVD (ft)*

Determine oil hydrostatic pressure :

*psi = oil specific gravity x 0.052 x TVD (ft)*

Determine surface pressure :

Sample Case : Oil bearing sand at 12.500 ft with a formation pressure

equivalent to 13.5 ppg. If the specific gravity of the oil is

0.5, what will be the static surface pressure during a drill

Stem test?

Determine formation pressure (psi):

FP (psi) = 13.5 ppg x 0.052 x 12,500 ft

= 8775 psi

Determine oil hydrostatic pressure :

psi = (0.5 x 8.33) x 0.052 x 12,500 ft

= 2707

Determine surface pressure :

Surface pressure (psi) = 8775 psi — 2707 psi

= 6068 psi