**Fracture Gradient Determination – SURFACE APPLICATION**

Method 1 : Mattews and Kelly Method

Where, F = fracture gradient (psi/ft)

P = formation pore pressure (psi)

σ = matrik stress at point of interest (psi)

D = depth at point of interest TVD (ft)

Ki = matrix stress coefficient, dimensionless

Procedure :

1. Obtain formation pore pressure (P) from electric logs, density measurements, or mud logging personel.
2. Assume 1.0 psi/ft as overburden pressure (S) and calculate σ as follows : σ = S – P
3. Determine the depth for determining Ki by :
4. Determine fracture gradient (psi/ft) :
5. Determine fracture gradient (psi) :

F (psi) = F x D

1. Determine maximum mud density (ppg) :

Sample Case : Casing setting depth = 12,000 ft

Formation pore pressure = 12.0 ppg

(Louisiana Gulf Coast)

1. P = 12.0 ppg x 0.052 x 12,00 ft

= 7488 psi

2. σ = 12,000 psi – 7488 psi

= 4512 psi

3.

4. From chart = Ki = 0.79 psi/ft

5.

6. Fracture pressure (psi) = 0.92 psi/ft x 12,000 ft

= 11,040 psi

7.

Method 2 : Ben Eaton Method

Where, S/D = overburden gradient, psi/ft  
 Pf/D = formation pressure gradient at depth of interest, psi/ft  
 y = Poisson’s ratio

Procedure :

1. Obtain overburden gradient from “Overburden Stress Gradient Chart.”  
2. Obtain formation pressure gradient from electric logs, density

measurements, or from logging operations.   
3. Obtain Poisson’s ratio from “Poisson’s Ratio Chart.”  
4. Determine fracture gradient using above equation.  
5. Determine fracture pressure, psi :

*psi = F x D*

6. Determine maximum mud density, ppg :

Example : Casing setting depth = 12,000 ft  
 Formation pore pressure = 12.0 ppg

1. Determine S/D from chart = depth = 12,000 ft

S/D = 0.96 psi/ft

2. Pf/D = 12.0 ppg x 0.052 = 0.624 psi/ft

3. Poisson’s Ratio from chart = 0.47 psi/ft

4. Determine fracture gradient :

5. Determine fracture pressure :

Psi = 0.92 psi/ft x 12,000 ft

= 11,040

6. Determine maximum mud density :

**FRACTURE GRADIENT DETERMINATION – SUBSEA APPLICATIONS**

In offshore drilling operations, it is necessary to correct the calculated fracture gradient for the effect of water depth and flowline height (air gap)above mean sea level. The following procedure can be used :

Sample Case : Air gap = lOO ft  
 Density of seawater = 8.9 ppg  
 Water depth = 2000 ft  
 Feet of casing below mudline = 4000 ft

Procedure :

1. Convert water to equivalent land area (ft):  
 a. Determine the hydrostatic pressure of the seawater :

HPsw = 8.9 ppg x 0.052 x 2000 ft

= 926 psi

b. From Eaton’s Overburden Stress Chart, determine the overburden stress

gradient from mean sea level to casing setting depth :

From chart : Enter chart at 6000 ft on left ; intersect curved line

And read overburden gradient at bottom of chart :

Overburden stress gradient = 0.92 psi/ft

c. Determine equivalent land area1 (ft) :

2. Determine depth for fracture gradient determination :

Depth (ft) = 4000 ft + 1006 ft

= 5006 ft

3. Using Eaton’s Fracture Gradient Chart, determine the fracture gradient

at a depth of 5006 ft :

From chart : Enter chart at a depth of 5006 ft; intersect the 9.0 ppg

line; then proceed up and read the fracture gradient at the

top of the chart :

Fracture gradient = 14.7 ppg

4. Determine the fracture pressure :

Psi = 14.7 ppg x 0.052 x 5006 ft

= 3827

5. Convert the fracture gradient relative to the flowline :

Fc = 3827 psi ÷ 0.052 ÷ 6100 ft

= 12.06 ppg

Where, Fc is the fracture gradient corrected for water depth and air

gap.