

AN MANUAL CALCULATION ON DEVIATED WELL IN PRESENCE OF SALT DOME

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Abstract: While drilling a well either vertical or horizontal type is their presence of salt dome than we have to deviate it from its original track path.so, I used some basic trigonometry calculation on assumed values to reach the target point.

IndexTerms: Deviated Well, Horizontal Well, Salt dome drilling

Introduction:

Drilling to get the hydrocarbon is not an easy one ,have to face many problems in the subsurface formation due to internal and external factor.Here in this article while drilling a well if a salt dome occurred, so we have to take a horizontal departure of 2000ft at with the TVD at the Target point to be 15000ft.Have to measure the depth and build up rate.

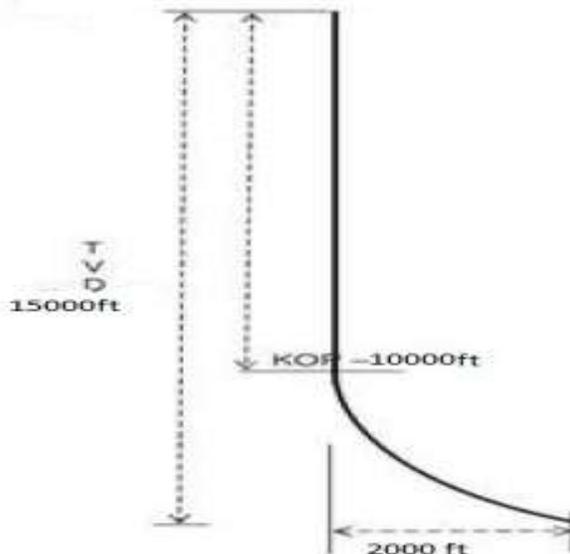
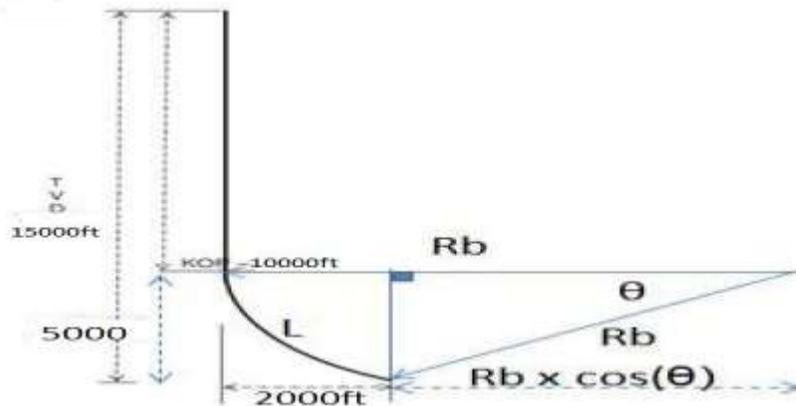


Fig: 1 General view of Deviated Well

METHODOLOGY:

Fig:2 Trigonometrical Diagram of deviated well



The formula for radius build (Rb) and length of hole (L) are listed below respectively;

$$Rb = \left(\frac{180}{\pi} \right) \times \left(\frac{1}{q} \right)$$

$$L = \left(\frac{\pi}{180} \right) \times Rb \times \theta$$

Where;

Rb = radius of build in ft

q = build rate degree/ft

θ = angle build in radius

Assumed Data :

Total TVD = 15,000 ft

TVD in build section = 15,000 – 10,000 = 5,000 ft

The horizontal departure = 2000 ft

From the diagram,

$Rb = 2000 + Rb \times \cos(\theta)$

$2000 = Rb \times (1 - \cos(\theta))$ —> **Equation 1**

Using trigonometric relationship

$5000 = Rb \times \sin(\theta)$ —> **Equation 2**

Equation 2 ÷ Equation 1 so you will get like this

$2000/5000 = Rb \times (1 - \cos(\theta)) / Rb \times \sin(\theta)$ —> **Equation 3**

Square the Equation 3 so you will get

$$\frac{\sin(\theta)^2}{4} = 1 - 2\cos(\theta) + \cos(\theta)^2 \quad \text{—>Equation 4}$$

Arrange the Equation 4 and we will get like this:

$$\sin(\theta)^2 = 4 - 8\cos(\theta) + 4\cos(\theta)^2 \quad \text{—>Equation 5}$$

According to the trigonometry relationship

$$\sin(\theta)^2 + \cos(\theta)^2 = 1$$

Therefore we can change the **Equation 5** like this:

$$1 - \cos(\theta)^2 = 4 - 8\cos(\theta) + 4\cos(\theta)^2$$

$$5\cos(\theta)^2 - 8\cos(\theta) + 3 = 0 \quad \text{—>Equation 6}$$

Using the polynomial relationship to arrange the equation as shown below:

$$(5\cos(\theta) - 3)(\cos(\theta) - 1) = 0$$

$\cos(\theta) = 3/5$ and $\cos(\theta) = 1$

Then we need to check which answer is correct.

$\cos(\theta) = 1$ is unreal because $\theta = 0$ degree.

Therefore, $\cos(\theta) = 3/5$ is the right answer for this case.

$$\theta = \cos^{-1}\left(\frac{3}{5}\right) = 53.13 \text{ deg}$$

From the Equation 1, able to get Rb via the Equation 1

$2000 = Rb \times (1 - \cos(\theta))$ —> **Equation 1**

$2000 = Rb \times (1 - \cos(53.13))$

$2000 = Rb \times (1 - 3/5)$

$Rb = 5000$ ft

can determine the length of build section via the equation below;

$$L = \left(\frac{\pi}{180} \right) \times Rb \times \theta$$

$$L = (\pi/180) \times 5000 \times 53.13 = 4634.11 \text{ ft}$$

Total MD from the rig to end of the build section = 10000 + 4634.11 = 14634.11 ft

Determine build rate via this following equation:

$$Rb = \left(\frac{180}{\pi} \right) \times \left(\frac{1}{q} \right)$$

$$5000 = (180/\pi) \times (1/q)$$

$$q = 0.011464 \text{ degree/ft}$$

We can answer in degree/100 ft by multiplied 100 therefore you will get the answer like this.

$$q = 1.4 \text{ degree/100 ft}$$

Result for the calculation:

The measure depth of the well = 14634.11 ft

The build-up rate = q = 1.14 degree/100 ft

Conclusion:

- By this calculated values the target of hydrocarbon can be reached
- Mathematical calculations were used in the field for observations
- But now many softwares are in use to reach the target well without any distraction on its path to reach the final spot
- From the calculation many basic ideas can be determined for self-study observation

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