FORECASTING THE RESERVOIR PERFORMANCE DATA OF OILFIELD IN LIBYA BY USING DECLINE CURVE ANALYSIS

Mahmoud Elsharafi, Mohamed Hussen Masaud, Faisal Bergigh
McCoy School of Engineering, Midwestern State University

Abstract

The purpose of this study is to determine and clear estimation of a reservoir performance in Libyan Oil fields by using Decline curves analysis technique and estimate the reservoir life for this field. Decline curves analysis commonly ordinarily applied to evaluate the original hydrocarbon in place, hydrocarbon reserves, and forecasting future production performance. The Decline Curves Analysis development was presented by Johnson and Bollens in (1928) and later on (1945) which is called "loss-ratio". Many discussions of the mathematical relationship between the past time, production rate, and the cumulative production depend on the decline rate. Decline curve analysis is a technique which might be stratified for a single well or whole reservoir by either production engineer or reservoir engineer. In oil industry, remaining reserves are the substantial target. Also, in this work we simulate the production operation data to find out the better matching of forecasting results and the economic impact of the selected reservoir. This research is an attempt to determine one of Libyan reservoir performance and determine which one of the three classifications of the Decline curves are Exponential, Hyperbolic, and/or Harmonic by using one of the most widespread important reliable methods to estimate the depletion of reservoir pressure with the consideration of the method limitations, the changes in the facilities downstream, and hydrocarbons production rate.

BACKGROUND

Sirte Oil Basin:

The Sirte basin in north-central Libya differs markedly from the neighboring Kufra, Murzuk, and Ghadames basins and it measures some 500 km north to south and 700 km east to west with an areal extent of approximately 375,000 sq km. It has an estimated sedimentary volume of 1.3 million cu km. The latter are broad, essentially un-faulted Paleozoic depressions that were sites of aggradation over much of Mesozoic time. In contrast, the Sirte basin comprises a series of regional distinct platforms and deep trough areas that began to develop in latest Jurassic-early Cretaceous time. The tectonic strain that developed from the complex movement between the mosaic of African sub-plates was responsible for a wide zone of lithosphere extension and thinning over the Sirte region, causing regional uplift, subsequent Mesozoic and selective Paleozoic erosion, intra-cratonic rifting, and collapse.

Decline curve analysis:

Decline curve analysis is the most common method used for extrapolate real reservoir production data and is considered as a direct reasonable estimation of reservoir or specific well. Decline curve depends on historical production data to extrapolate future production performance with consideration of other downstream products such as gas, condensate and water. While the most common being used a semi-log plot of rate of production versus time there are curves mainly are used because they emulate actual data which is easy to achieve, plot, analyze and gives results on time. Understanding the past behavior of the well and is carefully analyzing the production history can determine the causes of the decline trend changes and evaluate the economic recoverable reserve and predict the life of that well till reaching the abandonment phase. In decline curve analysis the timed production rate and the accumulated production at any time can also be measured but it still has limitation of usage that related to any surface and subsurface operation changes. If any of affected conditions on the well production rate well are existed that impacts on the shape of the curve which has a clear, direct effect on reserves estimation. Methods to evaluate the future performance oil fields have been developed over time anal-golly and exponential hyperbolic decline curves or might be by simulation studies. We selected this technique because of the limited uncertainty that is associated with the results.

The Arps equation 1945, of decline curve analysis approach was proposed more than sixty year ago. However a great number of studies on production decline analysis are still based on this empirical method. Many published papers have tried to interpret the Arps decline equation theoretically. The empirical Arps decline equation represents the relationship between production rate and time for oil wells during pseudo steady- state period

The decline curve most commonly used to represent or extrapolate the production data are members of a hyperbolic family defined by the following differential equation.

$$\frac{d}{dt}\left(\frac{q}{dq/dt}\right) = -b \Rightarrow \quad (1)$$

where:

q: oil production rate .

b: reservoir Factor

Direct integration of equation (1) gives:

$$\frac{q}{dq/dt} = -bt - \frac{1}{a_i} \Rightarrow \quad (2)$$

where:

ai: nominal Decline Rate

t: time

The constant "b" is a reservoir constant, which international oil field experience has shown its value to be normally between 0 and 1.0. Equation 2, can be easily integrated using the initial condition of q=qi at time t=0, to give the following general form for production decline in oil reservoir:

$$q = \frac{q_i}{(1 + a_i bt)^{1/b}} \Rightarrow \quad (3)$$

where:

qi is the Initial oil production rate. Some investigators claim that the value of "b" is directly proportional to the back-pressure test log-log exponent (n).

The three commonly recognized types of decline curves:

Constant percentage decline (exponential decline), Harmonic decline, and Hyperbolic decline.

Two main fitting techniques are popular with petroleum engineers; the first is normally used in case of small number of data point, only a pocket calculator is available. It is known as .the "Average lines method". The second and more popular method is known as the "least sum of square method". As the name implies, it required that the sum of the square of the discrepancies between the actual and calculated value must be a minimum.

This method has many advantages:

1) The equations are simple and their application required only a pocket calculator. It's also available as a direct function on the Microsoft Excel.

2) This method can be used easily to fit the data points to any form of equations.

3) Finally, it has proven to be the most “reliable” tool for extrapolation out said the range of the measured data in

PROJECT TASKS

This study was conducted to achieve the calculation and estimation of following:

- Porosity
- Water saturation
- Original Oil in Place
- Decline rate
- The life wells of the field.

STRATEGY ABOUT THE STUDY AREA

- The selected wells were chosen randomly to cover all the reservoir area. Figure 1 shows the Location Map. Figure 2 shows the base map and figure 3 shows the pressure distribution map of the field. Figure 4 shows the cross section illustrates the lithology of the reservoir and classifies the traps. Figure 5 shows the well Log Sample of One of the Selected Wells (Well-WQQ).
- The calculated results were based on the wells real data from field.
- Access to Crystal Ball software was used to eliminate the uncertainty of the outcomes.
- Excel spread sheet has used to interpret the log data to evaluate the porosity and the permeability over the reservoir.
- Estimated the performance of the wells in that reservoir section as well as in the reservoir in the whole area.
- Predicted the operation value and the net profit value of the reservoir with the current oil price and estimated the reservoir life.
- Monthly production rate for the selected wells is shown in the Table 1

EXPONENTIAL DECLINE CURVE CALCULATION EQUATIONS

The production rate at time t =STB/D

$$Qt = Qi\, e^{-Dt} \quad (4)$$

Exponential decline (nominal and effective*)*

$$Di = \frac{Qi - Qt}{Qi} \quad (5)$$

$$Di = 1 - e^{-D} \quad (6)$$

Effective Decline Rate

$$D = Ln\left(\frac{Qi}{Q}\right)^{\frac{1}{t}} \quad (7)$$

$$D = -Ln\left(1 - \frac{Qi - Qt}{Qi}\right) \quad (8)$$

Cumulative Oil Production

$$D = Ln\left(\frac{Qi}{Q}\right)^{\frac{1}{t}} \quad (9)$$

$$D = -Ln\left(1 - \frac{Qi - Qt}{Qi}\right) \quad (10)$$

$$Np = \frac{Qi - Qt}{D} \quad (11)$$

Well life on the economic level

$$T = (Qi/Q) - 1)/Di \quad (12)$$

Results and Data Interpretation

The petrophysical results including porosity and water saturation are illustrated in Table 3 and 4 respectively, using the formulas and equation shown in Table 2.

Results and Discussion

- Original Oil in Place calculated based on the contour map and thickness map where the measurement of reservoir bulk volume was estimated.
- Average Porosity was calculated arithmetically from the selected wells.
- The remaining oil in place equal to the Initial oil in place subtracted the produced oil.
- The cumulative oil production was found to be equal to 93 MMBBL.
- The remaining oil = 397.248MMBBL - 303.5 MMBBL = 93.7 MMBBL.
- The Exponential Annual Decline rate is 0.07.
- The initial rate was estimated 600 BBL /D per well.
- The Initial Gas Oil Ratio is 1250 Scf /STB.
- Table 5 shows the results of oil in place calculations.
- Figure 6. Shows the flow rate for well WQQ a) Dally flow rate b) Cumulative flow rate.
- Table 6. Shows the calculation results for the cumulative flow rate for the selected well.
- Table 7. Shows the forecasting for the next 15 years.

Conclusion

According to our results if the wells not developed by using a development method such as (water injection, artificial lift, and/or infill drilling), the annual oil and gas production rate at 2030 respectively is about 6 MSTB/D and 7.5 Mscf/D the annual oil and gas production will decrease

References

1- M.J. Fetkovich (Phillips Petroleum Co.)| M.E. Vienot (Phillips Petroleum Co.)| M.D. Bradley (Phillips Petroleum Co.)| U.G. Kiesow (Phillips Petroleum Co.

2- Evinger, H.H. and Muskat, M. 1942. Calculation of Theoretical Productivity Factor. *Trans., AIME*

3- Wiggins, M.L. 1994. Generalized Inflow Performance Relationships for Three-Phase Flow. *SPE Res Eng* 9 (3): 181-182. SPE-25458-PA. http://dx.doi.org/10.2118/25458-PA

4- Uhri, D.C. and Blount, E.M. 1982. Pivot Point Method Quickly Predicts Well Performance

5- Watson, T.A., Lane, S.H., and III, M.J.G. 1990. History Matching With Cumulative Production Data. *J Pet Technol* 42 (1): 96-100. SPE-17063-PA. http://dx.doi.org/10.2118/17063-PA http://www.fekete.com/software/rta/media/ ebhelp/c-te-analysis.htm

6- Depletion and Decline Curve Analysis in Crude Oil Production Licentiate thesis Mikael Höök Global Energy Systems Department for Physics and Astronomy, Uppsala University

Acknowledgements

We are grateful to the Midwestern State University Geosciences Department for graciously permission provided to the software. Special thank should be made to Dr. Scott Maddugh for sharing his knowledge as regards to this paper. We would also like to thank the McCoy School of Engineering and the EURECA program for their financial support. I am appreciative to my mentor, Dr. Mahmoud Elsharafi, for providing me with this wonderful opportunity.

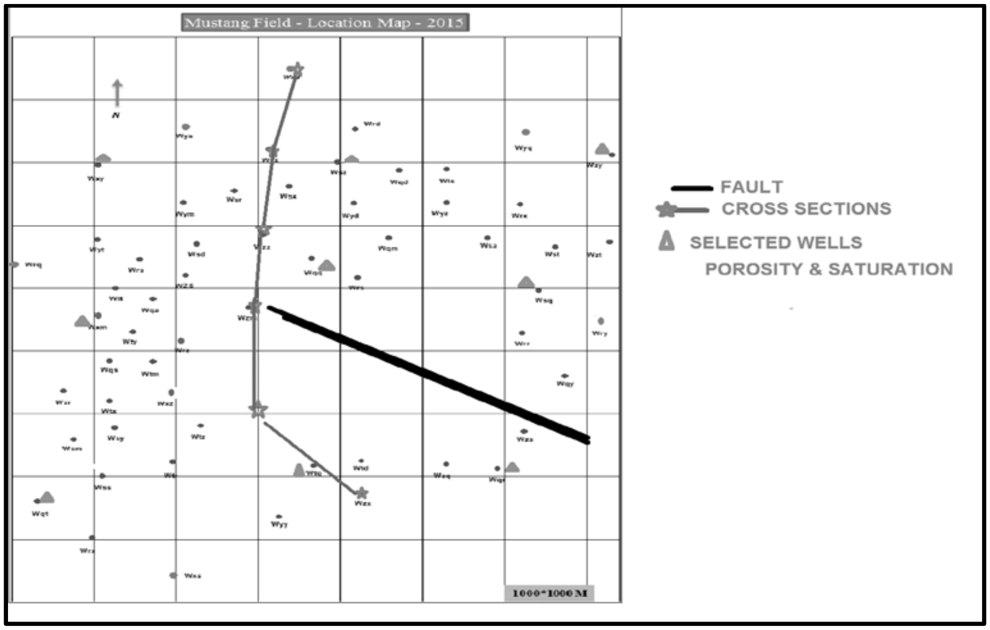

Figure 1: Location Map

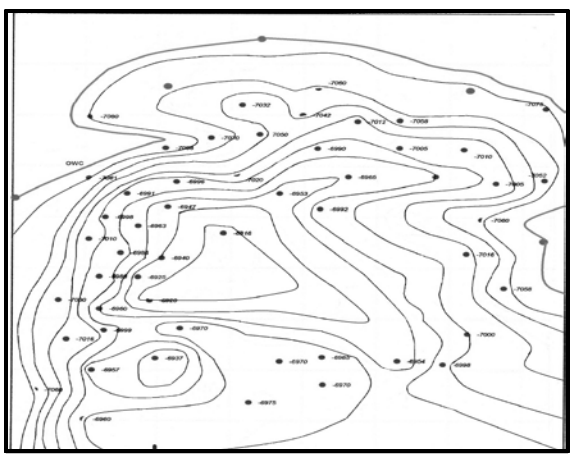

Figure 2. Field base map

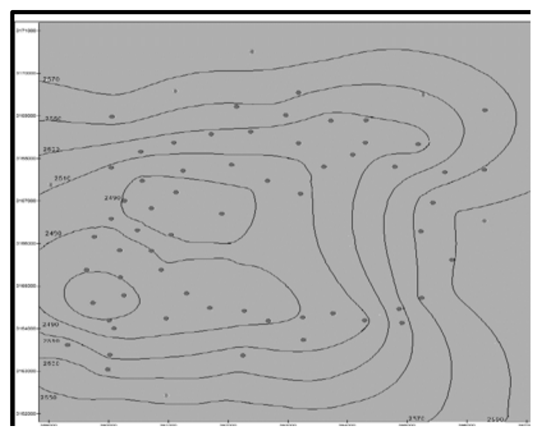

Figure 3. Pressure map of the field

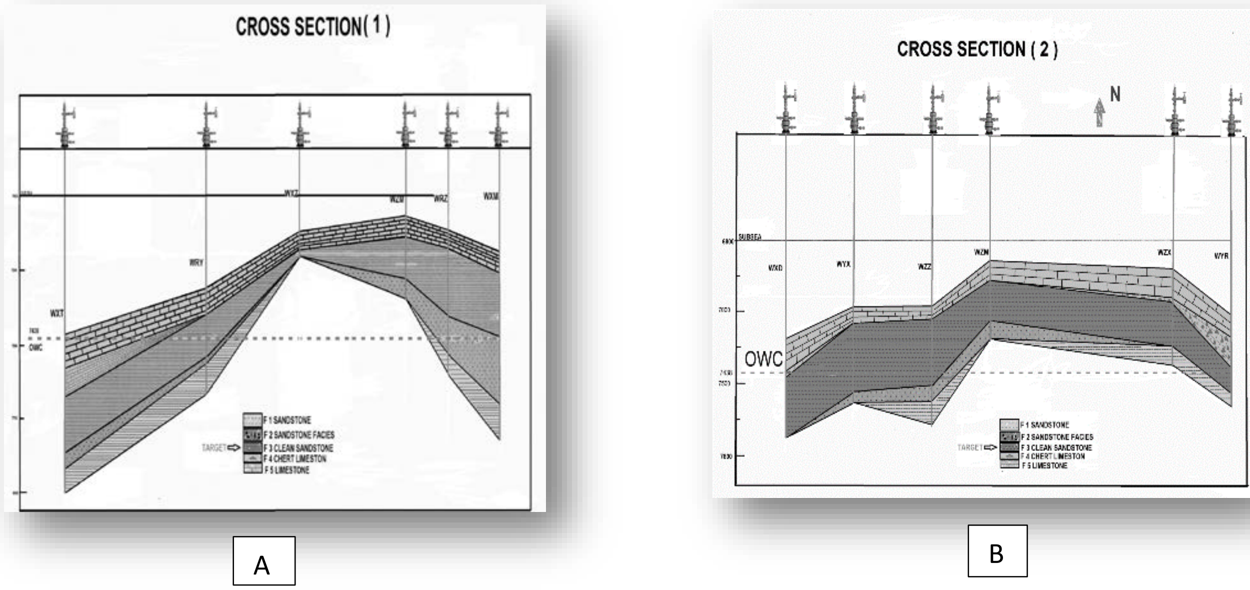

Figure 4. Cross section illustrates the lithology of the reservoir and classifies the traps

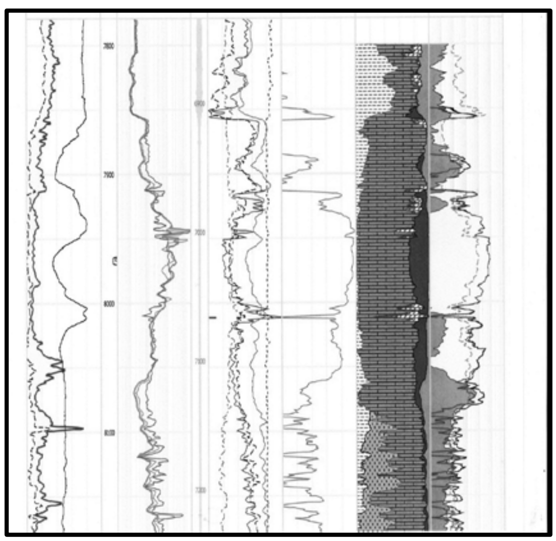

Figure 5. Well Log Sample of One of the Selected Wells (Well-WQQ)

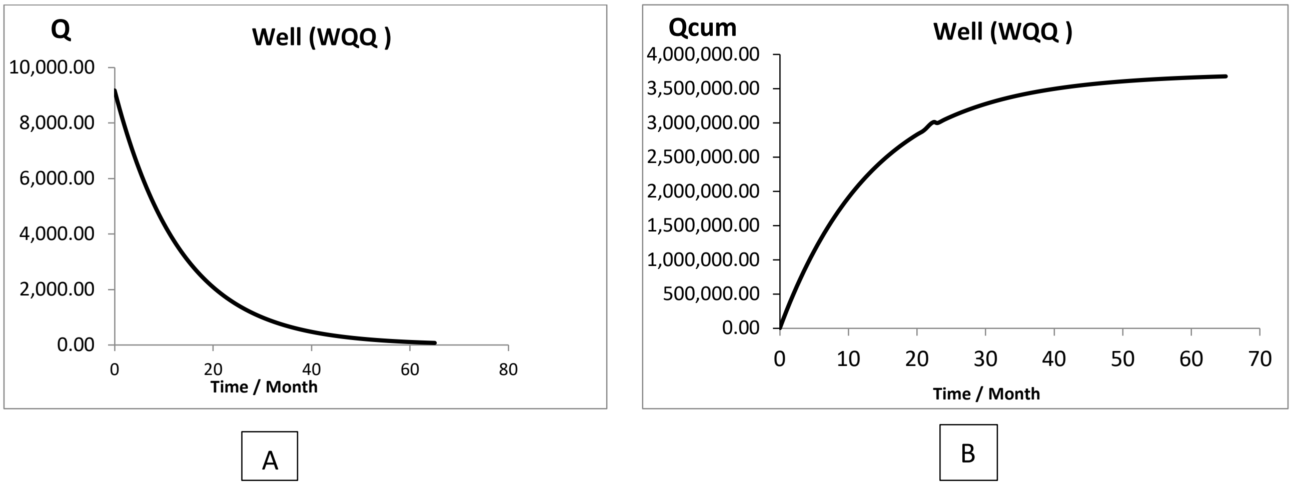

Figure 6. Shows the flow rate for well WQQ a) Dally flow rate b) Cumulative flow rate

Table 1. Monthly Production Rate for the Selected Wells

Date	WXY	WQT	WXM	WZY	WQR	WQQ	WQT	WSQ	WSZ
1/1/1995	1,395.21	1,391.67	941.32	-	523.06	899.77	440.81	-	590.61
2/1/1995	1,321.50	1,105.86	917.11	-	500.53	924.04	437.32	-	560.29
3/1/1995	994.16	859.94	774.19	-	458.13	1,176.03	714.45	483.23	500.55
4/1/1995	994.17	1,024.47	895.85	-	482.35	1,125.80	453.77	465	500.57
5/1/1995	1,403.81	1,041.81	833.94	626.1	386.24	1,111.97	424.32	512.68	471.97
6/1/1995	1,529.50	946.5	830.5	548.7	421.74	1,111.97	420.1	507.57	467.23
7/1/1995	1,367.42	956.06	879.87	577.65	421.73	970.81	508.35	504.87	491.87
8/1/1995	1,344.03	1,293.83	940.48	555.97	365.45	964.3	442.53	418.27	452.92
9/1/1995	1,350.10	1,628.10	901.5	534.33	412.2	1,350.24	442.53	467.63	447.3
10/1/1995	1,418.52	1,640.20	898.9	654.71	478.9	1,316.32	413.1	523.06	344.68
11/1/1995	1,376.93	864.27	765.3	606.2	478.9	1,251.37	362.87	500.53	391.43
12/1/1995	1,372.61	856.48	778.55	573.29	534.32	1,440.16	338.61	458.13	381.9
1/1/1996	1,399.45	889.39	887.65	573.29	539.52	1,295.55	333.42	482.35	1,055.65
2/1/1996	1,345.76	818.38	871.21	592.34	445.97	1,361.38	380.17	386.24	410.48
3/1/1996	1,294.68	807.97	873.81	490.16	451.16	1,264.35	388.84	421.74	482.35
4/1/1996	1,249.67	852.13	639.1	490.17	451.17	1,480.87	335.74	421.73	363.7
5/1/1996	1,098.94	880.71	940.48	387.97	228.65	1,255.71	320.42	365.45	365.45
6/1/1996	1,247.03	808.83	945.67	374.1	239.9	1,301.60	326	412.2	376.7
7/1/1996	1,118.00	830.48	1,189.03	472.84	233.81	1,389.94	340.35	383.65	357.65
8/1/1996	1,048.74	864.29	1,189.00	482.35	233.81	1,396.00	326.48	383.65	400.07
9/1/1996	1,027.10	864.27	882.43	588.87	233.8	1,300.73	382.77	392.3	404.43
10/1/1996	1,111.94	864.26	1,018.42	482.39	158.48	1,580.45	321.67	410.48	356.77
11/1/1996	1,111.97	842.63	1,028.80	537.93	158.47	1,491.27	326.47	533.5	414.8
12/1/1996	1,169.10	842.61	1,028.81	544.68	158.48	1,491.26	326.48	526.37	414.81

Table 2. Shows the Formulas and Equations for Porosity and Saturation Calculation

Porosity Type	Equations
Sonic Logs	Øs = (Δtl - Δt ma) / (Δtf - Δt ma)
Sonic Logs Correlation	Øs corr =(Øs -(Vsh * 0.37)
Sonic Logs Correlation (Oil)	Øs corr (oil) =(Øs corr * 0.37)
Density Logs	Øρ = (ρma- Δt b) / (ρma - ρ f)
Density Logs correlation	Øρ corr = Øρ * (Vsh * 0.18)
Neutron Logs	Øn = (Øn fl - Øn log) / (ρb - ρ fl)
Neutron-Density Logs	Øn-ρ = √((Øn log)^2 + (Øρ)^2) /2
Formation Factor	F = 0.81 / Ø^2
Initial Water Saturation	Swi = √(F * Rw) / Rt
Residual Water Saturation	Sxo = √(F * Rf) / Rxo
Initial Water Saturation	Soi = 1 - Swi
Residual Water Saturation	Sor = 1 - Sxo

Table 3. Porosity Results

DEPTH	GR	I GR	V (sh)	Δt log	Ø sonic	Ø sonic corr	Ø sonic cc	Ø N log	Ø N	Ø N corr
7700	25	0.42	0.16	114	0.47	0.41	0.29	0.42	3.63	0.34
7710	17.25	0.29	0.09	90	0.3	0.27	0.19	0.18	3.34	0.13
7720	3	0.05	0.01	93	0.32	0.32	0.22	0.19	3.36	0.18
7730	3.45	0.06	0.01	88	0.29	0.28	0.2	0.17	3.33	0.16
7740	2.85	0.05	0.01	85	0.27	0.26	0.18	0.14	3.29	0.13
7750	3	0.05	0.01	90	0.3	0.3	0.21	0.16	3.32	0.15
7760	9.15	0.15	0.04	93	0.32	0.31	0.21	0.18	3.35	0.16
7770	7.5	0.13	0.03	94	0.33	0.32	0.22	0.19	3.36	0.18
7780	3	0.05	0.01	91	0.31	0.3	0.21	0.21	3.38	0.2
7790	2.93	0.05	0.01	97	0.35	0.35	0.24	0.2	3.37	0.2
7800	3	0.05	0.01	92	0.31	0.31	0.22	0.2	3.37	0.19
7810	3.15	0.05	0.01	88	0.29	0.28	0.2	0.17	3.34	0.17
7820	3.15	0.05	0.01	88	0.29	0.28	0.2	0.15	3.31	0.14
7830	0.75	0.01	0	76	0.2	0.2	0.14	0.11	3.26	0.11
7840	0.3	0.01	0	80	0.23	0.23	0.16	0.13	3.28	0.12
7850	1.43	0.02	0.01	82	0.24	0.24	0.17	0.14	3.3	0.14
7860	0.3	0.01	0	75	0.19	0.19	0.14	0.17	3.33	0.16
7870	0	0	0	79	0.22	0.22	0.16	0.2	3.37	0.2
7880	0.75	0.01	0	79	0.22	0.22	0.16	0.2	3.37	0.2
7890	3.15	0.05	0.01	80	0.23	0.23	0.16	0.2	3.36	0.19
7900	2.7	0.05	0.01	78	0.22	0.21	0.15	0.1	3.25	0.1
7910	3.3	0.06	0.01	73	0.18	0.18	0.12	0.12	3.27	0.11
7920	4.8	0.08	0.02	77	0.21	0.2	0.14	0.16	3.32	0.15
7930	3	0.05	0.01	75	0.19	0.19	0.13	0.14	3.3	0.14
7940	2.25	0.04	0.01	73	0.18	0.18	0.12	0.18	3.34	0.17
7950	1.35	0.02	0	78	0.22	0.21	0.15	0.15	3.31	0.15
7960	2.85	0.05	0.01	71	0.17	0.16	0.11	0.13	3.28	0.12
7970	3.75	0.06	0.01	70	0.16	0.15	0.11	0.08	3.23	0.08
7980	4.2	0.07	0.02	65	0.12	0.12	0.08	0.07	3.21	0.06
7990	7.5	0.13	0.03	65	0.12	0.11	0.08	0.05	3.19	0.04
8000	7.65	0.13	0.03	68	0.14	0.13	0.09	0.06	3.2	0.04

Table 4. Saturation Results

DEPTH	ρ log	Ø D	Ø D corr	Rt	RXO	Ø (N-D)	Ø (N-D) corr	Ø 1	Sxo	Shr	B	C	Sw
7700	2.28	0.25	0.23	0.8	0.8	0.35	0.25	0.25	1.51	0	8.94	0.2	0.88
7710	2.23	0.28	0.27	5	5	0.24	0.23	0.24	0.6	0.4	1.18	0.11	0.37
7720	2.2	0.3	0.3	15	15	0.25	0.25	0.27	0.35	0.65	0.49	0.01	0.21
7730	2.27	0.26	0.26	17	10	0.22	0.22	0.24	0.49	0.51	0.34	0.02	0.22
7740	2.32	0.23	0.23	21	10	0.19	0.2	0.2	0.57	0.43	0.21	0.01	0.23
7750	2.26	0.26	0.26	29	9	0.22	0.22	0.24	0.53	0.47	0.2	0.01	0.17
7760	2.2	0.3	0.29	30	9	0.25	0.25	0.26	0.44	0.56	0.23	0.05	0.14
7770	2.26	0.26	0.26	30	10.1	0.23	0.23	0.24	0.46	0.54	0.19	0.04	0.16
7780	2.19	0.3	0.3	14	7	0.26	0.27	0.28	0.51	0.49	0.57	0.01	0.21
7790	2.15	0.33	0.33	7	5.5	0.27	0.29	0.3	0.54	0.46	1.32	0.01	0.28
7800	2.2	0.3	0.3	6	5.8	0.25	0.26	0.27	0.57	0.43	1.31	0.01	0.32
7810	2.25	0.27	0.27	5.5	6	0.23	0.24	0.25	0.62	0.38	1.17	0.01	0.37
7820	2.23	0.28	0.28	6	7	0.22	0.24	0.25	0.57	0.43	1.07	0.01	0.36
7830	2.37	0.2	0.2	8	15	0.16	0.17	0.18	0.55	0.45	0.41	0	0.44
7840	2.28	0.25	0.25	7	13	0.2	0.21	0.22	0.48	0.52	0.72	0	0.38
7850	2.3	0.24	0.24	5	9	0.2	0.21	0.22	0.58	0.42	0.99	0.01	0.45
7860	2.3	0.24	0.24	4.5	8	0.21	0.21	0.22	0.61	0.39	1.16	0	0.46
7870	2.48	0.13	0.13	4.2	8.5	0.17	0.15	0.15	0.88	0.12	0.59	0	0.7
7880	2.48	0.14	0.14	4.7	9	0.17	0.15	0.15	0.84	0.16	0.53	0	0.65
7890	2.52	0.11	0.11	4.9	9.5	0.16	0.13	0.13	0.91	0.09	0.38	0.01	0.73
7900	2.44	0.16	0.16	4.8	8	0.13	0.14	0.14	0.91	0.09	0.48	0.01	0.67
7910	2.39	0.19	0.19	5	9	0.16	0.17	0.17	0.71	0.29	0.63	0.02	0.56
7920	2.41	0.18	0.17	5	8	0.17	0.17	0.17	0.75	0.25	0.62	0.02	0.55
7930	2.44	0.16	0.16	3.4	5.5	0.15	0.15	0.15	1.03	-0.03	0.79	0.01	0.73
7940	2.37	0.2	0.2	3.5	6.5	0.19	0.19	0.19	0.77	0.23	1.14	0.01	0.6
7950	2.43	0.17	0.17	3.3	6	0.16	0.16	0.16	0.95	0.05	0.89	0.01	0.72
7960	2.47	0.14	0.14	3.7	7	0.14	0.14	0.14	1.02	-0.02	0.57	0.01	0.79
7970	2.52	0.11	0.11	4.8	8	0.1	0.1	0.1	1.22	-0.22	0.26	0.02	0.89
7980	2.55	0.09	0.09	6.8	13	0.08	0.08	0.08	1.09	-0.09	0.12	0.02	0.9
7990	2.54	0.1	0.09	8	15	0.08	0.08	0.08	0.9	0.1	0.09	0.04	0.83
8000	2.55	0.1	0.09	8	10	0.08	0.08	0.08	1.17	-0.17	0.09	0.04	0.81

Table 5. Oil in Place Calculation Result

Average porosity (Ø)	0.21%
Average water Saturation (Sw)	0.36%
Bulk Volume (A*H)	2953869048 Ft^3
OOIP =A * H * Ø * (1 - Sw)	397000000 BBL

Table 6. Shows the Calculation Results for Cumulative Flow Rate

Tday	Tmonth	D	Q	Qcum
0	0	0	9173.783	0
30.4167	1	0.07412	8518.444	259340
60.8333	2	0.14823	7909.921	500382
91.25	3	0.22235	7344.868	724426
121.667	4	0.29646	6820.18	932678
152.083	5	0.37058	6332.974	1126259
182.5	6	0.4447	5880.572	1306209
212.917	7	0.51881	5460.487	1473495
243.333	8	0.59293	5070.412	1629016
273.75	9	0.66704	4708.202	1773605
304.167	10	0.74116	4371.867	1908038
334.583	11	0.81528	4059.559	2033034
365	12	0.88939	3769.56	2149261
395.417	13	0.96351	3500.278	2257342
425.833	14	1.03762	3250.232	2357852
456.25	15	1.11174	3018.048	2451328
486.667	16	1.18586	2802.451	2538267
517.083	17	1.25997	2602.255	2619132
547.5	18	1.33409	2416.361	2694352
577.917	19	1.4082	2243.746	2764327
608.333	20	1.48232	2083.461	2829427
638.75	21	1.55643	1934.627	2889997
669.167	22	1.63055	1796.425	2986560
684.375	22.5	1.66761	1731.072	3013319
699.583	23	1.70467	1668.096	2998802
730	24	1.77878	1548.934	3047610
760.417	25	1.8529	1438.284	3093039
790.833	26	1.92701	1335.539	3135325
821.25	27	2.00113	1240.133	3174690
851.667	28	2.07525	1151.543	3211340
882.083	29	2.14936	1069.282	3245466
912.5	30	2.22348	992.8965	3277245
942.917	31	2.29759	921.9679	3306844
973.333	32	2.37171	856.1063	3334414
1003.75	33	2.44583	794.9495	3360099
1034.17	34	2.51994	738.1615	3384030
1064.58	35	2.59406	685.4302	3406331
1095	36	2.66817	636.4658	3427116
1125.42	37	2.74229	590.9992	3446492
1155.83	38	2.81641	548.7806	3464556
1186.25	39	2.89052	509.578	3481401
1216.67	40	2.96464	473.1758	3497112
1247.08	41	3.03875	439.374	3511768
1277.5	42	3.11287	407.9869	3525443
1307.92	43	3.18699	378.8419	3538205
1338.33	44	3.2611	351.779	3550117
1368.75	45	3.33522	326.6493	3561239
1399.17	46	3.40933	303.3148	3571626
1429.58	47	3.48345	281.6472	3581328
1460	48	3.55757	261.5275	3590394
1490.42	49	3.63168	242.845	3598867
1520.83	50	3.7058	225.4971	3606789
1551.25	51	3.77991	209.3885	3614196
1581.67	52	3.85403	194.4306	3621126
1612.08	53	3.92815	180.5413	3627611
1642.5	54	4.00226	167.6441	3633680
1672.92	55	4.07638	155.6683	3639364
1703.33	56	4.15049	144.548	3644688
1733.75	57	4.22461	134.2221	3649678
1764.17	58	4.29873	124.6338	3654355
1794.58	59	4.37284	115.7305	3658741
1825	60	4.44696	107.4631	3662857
1855.42	61	4.52107	99.7864	3666720
1885.83	62	4.59519	92.65806	3670347
1916.25	63	4.6693	86.03894	3673755
1946.67	64	4.74342	79.89266	3676958
1977.08	65	4.81754	74.18545	3679971

Table 7. The Forecasting for the Next 15 Years

YEAR	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2027	2028	2029	2030
OAPR	17.1	15.9	14.8	13.8	12.9	12	11.2	10.5	9.7	9.1	8.5	7.4	6.9	6.4	6
GAPR	21.3	19.9	18.5	17.3	16.1	15	14	13.1	12.2	11.4	10.6	9.2	8.6	8	7.5