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DEVELOPMENT OF HYDROCARBON POTENTIAL OF FAHLIAN ANTICLINE ON FUTURE WELLS IN WEST KARUN

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Abstract

Making models of oil fields and performing the calculations of fields development of the reservoirs basins and systematic reservoirs are considered as quality ideas on the process of oil and gas exploration from the lower layers. The engineer in charge is responsible to calculate the development of an oil field based on individual concepts resulted from geological- geo-physical and hydrodynamic studies of wells. The main parameters include relative permeability, pressure gauge and indices of static and dynamic information production of reservoirs. The graph of gas to oil ratio illustrates that production is increased from the initial value as the oil production flow is enhanced. By reducing the flow of oil production, the ratio of gas to oil can be returned to its original level. Production water cutting diagram indicates that water cutting rate is rapidly increased through increasing oil production flow. In Yadavaran oil field, Hosseinieh anticline on Fahlian have been discovered by geophysical surveys. The drilling process of wells and reservoir simulation is a three-dimensional static and dynamic one. The Eclips and Petrol software was applied to do the segmental model from the model of the whole understudy field. In the north of Yadavaran oil field, wells 29, 28, 27, 26 have been created as future wells to produce more oil in the future due to the situation of oil, gas and water.

Keywords: Reservoir - Well testing - Well Production Potential - Segmental Simulation - Field Production Data - Pressure at the Bottom of the Well – Pressure on Top of the Well.

INTRODUCTION

Cortazar Eduardo et al. (1999) presented the "Real Options" model to evaluate natural resource exploration investment (copper or oil), which is associated with price uncertainties and geological parameters. After completing different phases of exploration, investment analysis and extraction were begun. In all stages from exploration, range opening, and extraction to reconstruction, all activities were optimized and the basic uncertainties in the form of an indeterminate parameter were significantly analyzed and reduced by the real option model method.

Berteig et al. (1988) predicted the pore volume of hydrocarbons through considering uncertainty. In consequence, the accidental (probable) modeling was used to predict more precisely and decline the uncertainties. Spatial concepts and adaptation of existing wells were measured. In the case study, a confidence level of 92%, which is close to 95%,

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was predicted to be the optimal level, with about 95% of the pore volume observed in one well and 24% in the other 8 wells. They can be identified by the optimal drilling location. Rahmavati (2011) combined field operations and field optimization in oil and gas. Combining modeling with optimization in the oil industry is one of the most important methods of oil field development and economic evaluation. This paper aims to combine these models together in order to optimize the performance of the whole system and the whole project.

Combining seismic information within a random function can be done using deterministic interpolation algorithms such as State Adjoint (Qian, Leung, 2006), simulated Annealing (Stoffa, Sen, 1995), kriging with external drift (Govaerts, 1997), and Ckirging (Dubrule, 2003), stochastic simulation (Xu et al., 1992). In the present study, the geo- statistical method has been used to influence the spatial nature of cavities and structures. According to the fact that the heterogeneity and variability of variables in three dimensions is important, it is significant to identify vertical and horizontal changes in reservoir parameters and model it using surface and deep information of rocks and sediments (Gorelick, Kolterman, 1996). Geo- statistical methods have been widely used in identifying micro-surface heterogeneity and related uncertainties, which have been presented in numerous books and review articles. The human factor (reservoir engineer) will undoubtedly be the most significant parameter in this process.

METHODS

Fluid properties and reservoir rock dynamics are listed in the PROPS section. Reservoir rock dynamic properties are those properties that are defined as a function of pressure (such as rock compressibility) or fluid saturation (such as relative permeability). These properties are different from the static properties of the reservoir rock (such as absolute permeability) introduced in the GRID section. Holistically, the information required in the PROPS section is:

1) Reservoir fluid properties: Fluid properties (PVT) as a function of fluid pressure-density under standard conditions
2) Reservoir rock dynamics: Relative permeability as a function of fluid saturation degree - Capillary pressures as a function of fluid saturation degree - Reservoir rock compressibility

The purpose of entering the properties of reservoir fluids is black oil simulators balance mass during each simulation for each cell. Combined simulators, such as the Eclipse 300, perform molar balance instead of mass balance. In black oil simulators, the properties of fluids are read using a number of tables. In hybrid simulators, the properties of fluids are determined using equations of state and flash calculations. The mass balance in Eclipse 100 is performed by means of Equation 104:

$$m_n - m_{an} = m_{uncumulcord} + m_{injecied} - m_{procticad} \quad (1)$$

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In which: m is the fluid mass in the reservoir conditions. To solve the equation 4-1, it is necessary to access the masses of fluids in the conditions of the reservoir. On the other hand, the injection and production volumes in surface conditions are the only parameters which can be directly measured. The information of the fluids' properties and specifically the volume co- efficiency of the fluid formation is practiced to convert surface volumes to volumes in the reservoir's conditions. The density of fluids is practiced to change volume into mass. Thus, the mass of fluids is calculated by the following relation:

$$m_r = V_{sl}.B\rho_r \quad (2)$$

In which- Fluid mass in reservoir conditions = fluid volume in surface conditions B = volumetric coefficient of fluid formation of oil, gas and water density method in reservoir conditions (relations 3, 4, and 5)

The fluid mass in reservoir conditions

The fluid volume in surface conditions

Volumetric coefficient of fluid formation of oil

Gas and water density method in reservoir conditions

m_r : Fluid mass in tank conditions

V_{sc} : Fluid volume in surface conditions

B : Volume coefficient of fluid formation

ρ_r : Oil Density: Gas, and Water in Reservoir Conditions (Equations 4-3, 4-4, and 4-5):

$$\rho_{or} = \frac{\rho_{osc} + R_s\rho_{soc}}{B_0} \quad (3)$$

$$\rho_{er} = \frac{\rho_{gsc} + R_s\rho_{ovc}}{B_g} \quad (4)$$

$$\rho_{wr} = \frac{\rho_{WRC}}{B_W} \quad (5)$$

In which:

$\rho_{or}, \rho_{gr}, \rho_{wr}$= The densities of oil, gas and water in reservoir conditions

$\rho_{ogc}, \rho_{gsc}, \rho_{wgr}$**=** The densities of oil, gas and water in surface conditions

B_o, B_g, B_w =volumetric coefficient of fluid formation of oil

R_S= gas dissolved in oil

R_v= oil evaporated in gas - $1/R_s$

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Information on reservoir fluid properties is obtained after PVT and field tests.

RSCONSTT: This section makes it possible to determine an R for the whole reservoir. If the properties of dead oil are divided into more than one area, the RSCONSTT parameter is used.

Gravity: The three items of this parameter are: 1- API degree of oil 2- Relative density of water (based on pure water) 3- Relative density of gas (based on air) - Compressibility coefficient of reservoir pressure drops, in addition to hydrocarbon fluid, on rock the tank is also effective and changes its pore volume.

Water Properties: Water is considered pure in the Eclipse simulator, and it is not mixed with oil. Also, it does not contain dissolved gas. Since the compressibility of water is low, its value is assumed to be constant. Water properties are entered into the model using the following five columns: 1. Reference pressure (Pref) for the second and fourth items. This item does not have a default value and therefore must be entered. 2. Volumetric coefficient of water formation at reference pressure (Bw) 3- Water compressibility coefficient (cw) 4- Water viscosity at reference pressure (ɥ) 5- Water viscosity compressibility (cvw)Well no 5 has the pressure at the bottom asnd on top of the well.

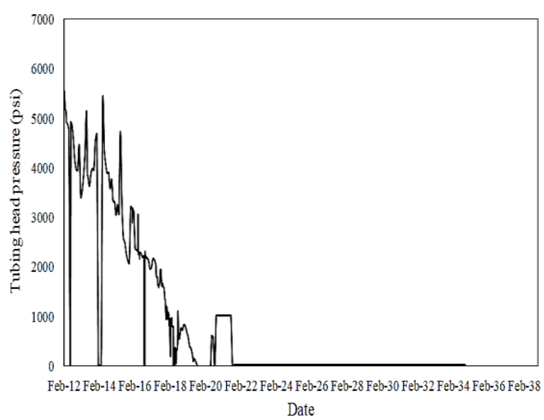

Fig 1: Pressure to the well

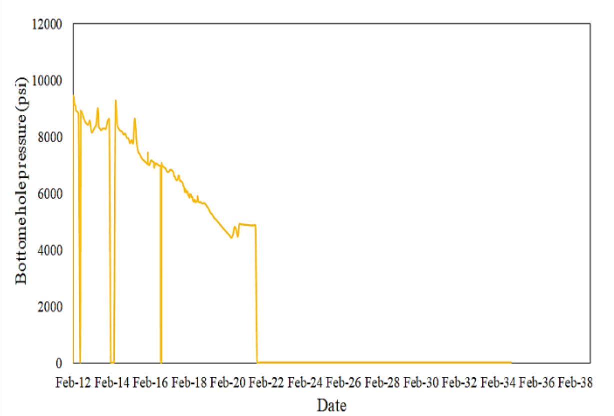

Fig 2: Well pressure

Well No. 7: Gas production and water production does not have zero (0)

In well number 5, the value of the bottom pressure reaches more than 8000psi in its maximum value and more than 4000psi in its lowest value. From the twenty-second day onwards, the bottom pressure of the well reaches zero (0). In its maximum value reaches more than 5000psi and in its lowest value reaches less than 1000psi. From the twenty-second day onwards, the well bottom pressure reaches zero (0).

In well number 7, the amount of gas and water is checked. The amount of gas production in this well reaches more than 6000MSCF / Day and in its lowest amount reaches more than 1000MSCF / Day and from the twenty-sixth day onwards the amount of gas finally reaches zero (0). The amount of water production in well number 7 reaches zero (0). Well no 7 has the pressure at the bottom asnd on top of the well.

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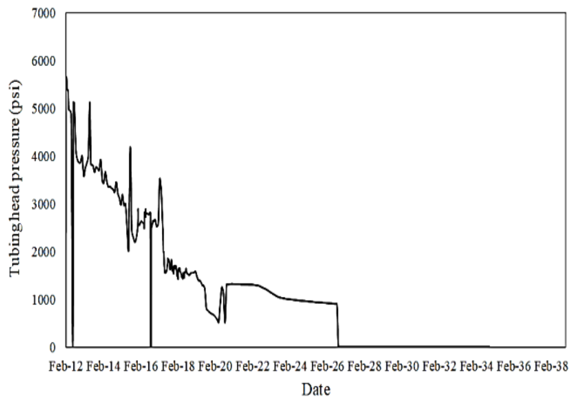

Fig 3: Pressure to the Well

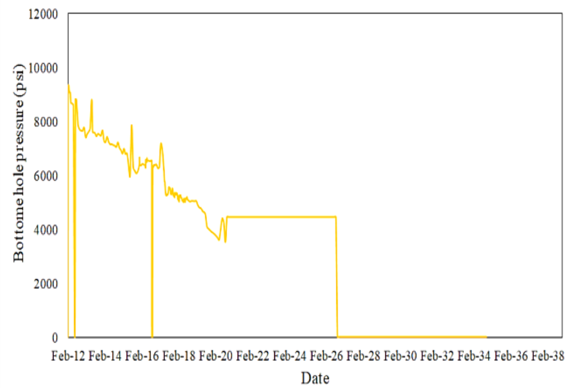

Fig 4: Well Pressure

In well number 7, oil production at the bottom of the well shows a value of 8000 psi. The minimum value is 4000 psi. Finally, from the twenty-sixth day, it reaches zero (0). With the reduction to its minimum value, it reaches 1000psi, which from the twenty-sixth day onwards, the well pressure in well number 7, reaches zero (0).

Well number 8: In well number 8, the value of the cumulative in its maximum value reaches more than 6000psi and its discharge amount reaches 7000psi in its maximum value.

HOS2-ST1 Well

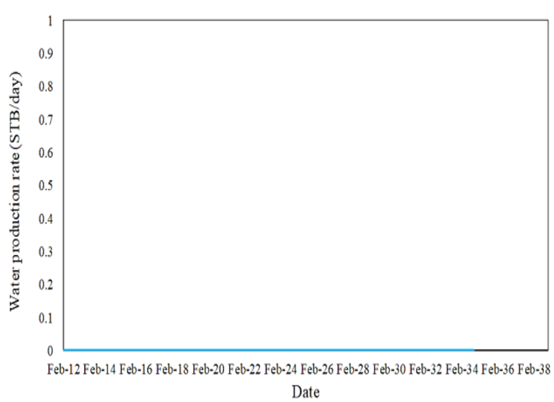

Fig 5: Gas Production

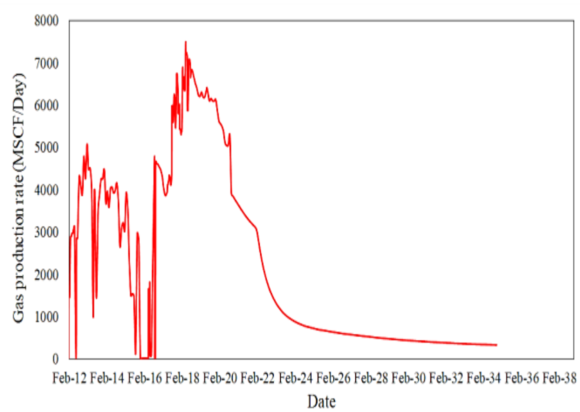

Fig 6: Water Production

Hosseinieh well: In Hosseinieh well, the amount of gas in its maximum amount reaches 7000MSCF / day and in the lowest amount of self-contained gas reaches less than 1000MCSF / day. The amount of water in Hosseinieh well reaches zero (0).

Hosseinieh well has well pressure at the bottom and well pressure on the top.

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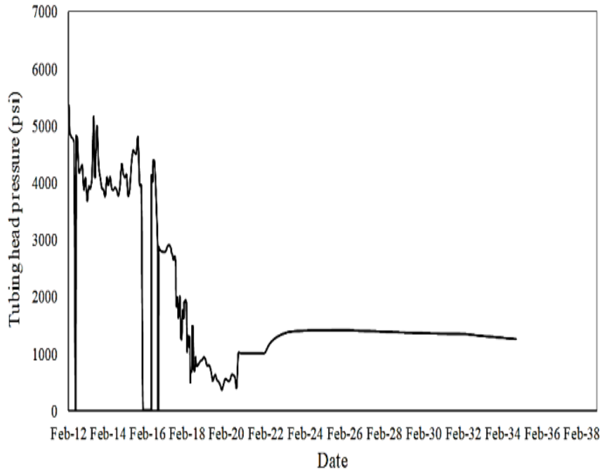

Fig 7: Pressure to the Well

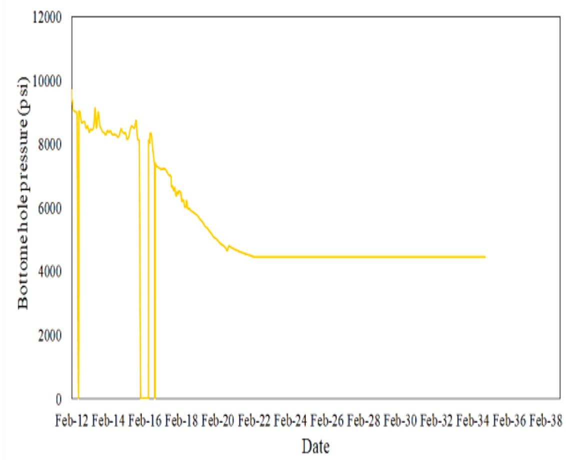

Fig 8: Well Pressure

In Hosseinieh well, the pressure at the bottom of the well reaches to its highest amount which is more than 8000psi and its lowest amount at the bottom of the well is more than 4000psi. The pressure at the top of Hosseinieh well in its highest amount is 5000psi and its lowest amount is less than 1000psi.

Oil production in FU-26 Well

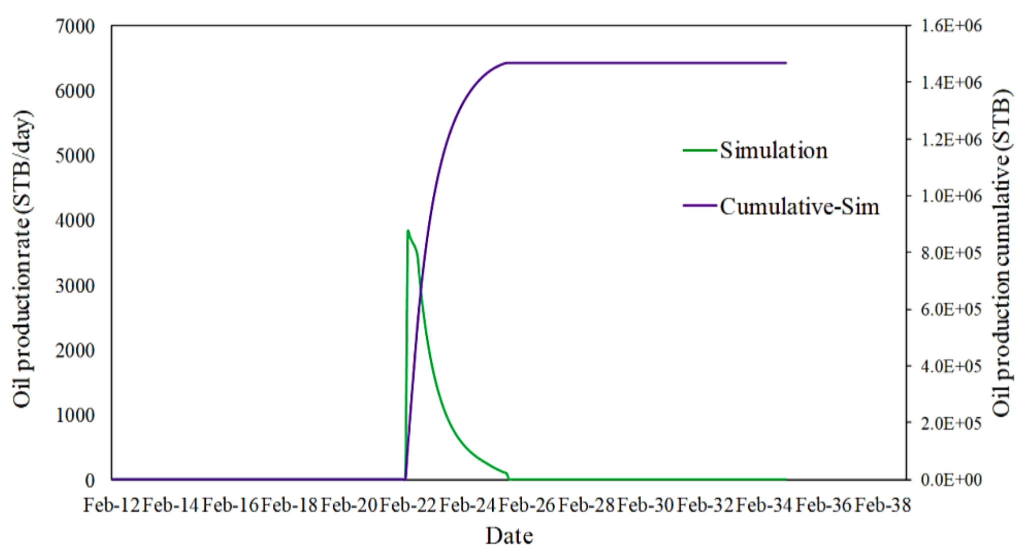

Fig 9: Oil well: FU-26 Well (well no 26 is a future well)

Oil well: FU-26 Well: well, no 26 is a future well which its cumulative value reaches its maximum amount of 6000 STB / day and the amount of production flow in well number 26 reaches its maximum value of more than 3000 STB / day and after twenty-four days it reaches the value of zero (0). Well No. 26 Future well has gas production and water production

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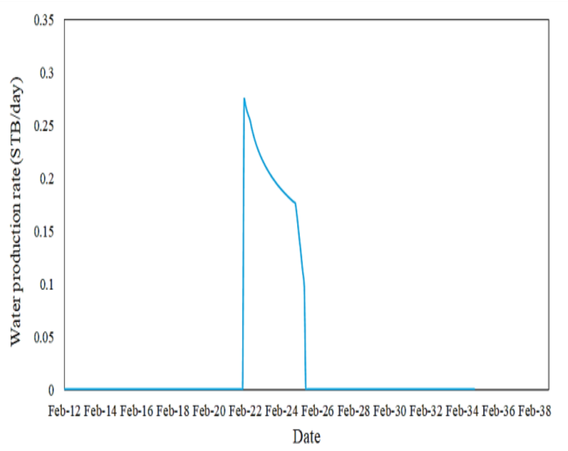


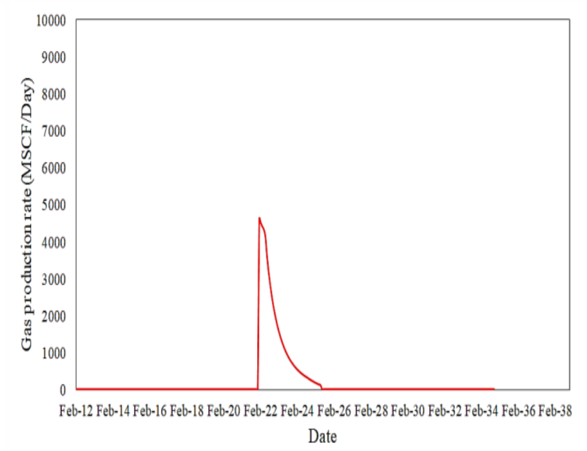
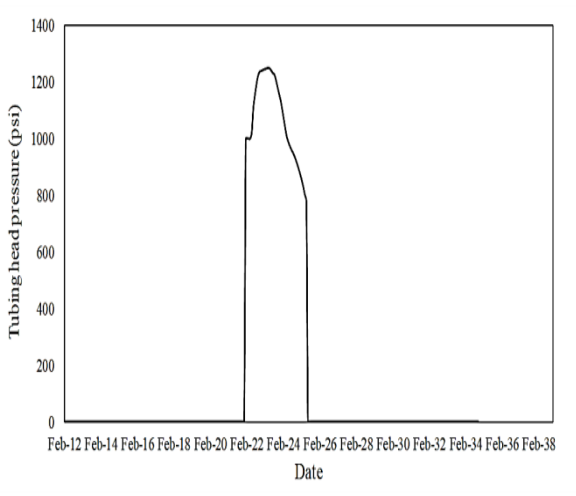


Fig 10: Gas production **Fig 11: Water production**

Gas production in well number 26: well number 26 is the future well that the amount of gas production in well number 26 shows its maximum amount of more than 4000 MSCF / day, which on the twenty-sixth day the amount of gas production starts to decrease to zero (0). Water production in well number 26: well No. 26 is the next well, where the amount of water production in well No. 26 at its maximum reaches more than 0.25 STB / day on the twenty-second day, and on the twenty-sixth day, the amount of water production begins to decrease and finally reaches zero (0).

Oil production in well number 26 of future wells: well pressure and well pressure.



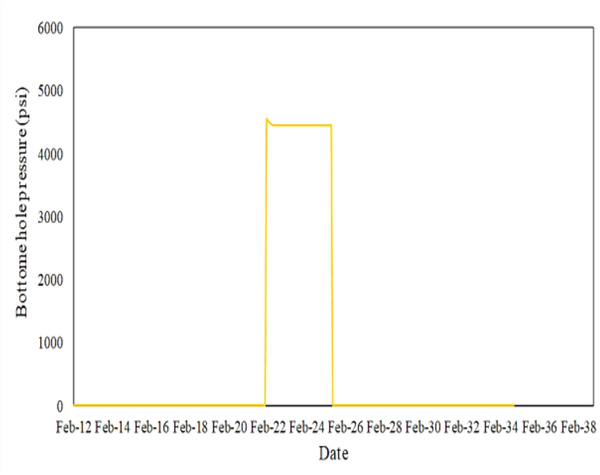


Fig 12: Pressure to the well **Fig 13: Well pressure**

Well number 26 Future well: Well pressure: Well number 26, which is the next well, the bottom pressure of the well, at its maximum value reaches more than 4800 psi, and on the twenty-second day, on the twenty-sixth day, the bottom well pressure reaches more than 4000 psi and finally zero (0). 26, which is the next well, reaches 1200 psi at its maximum, and at its lowest value on the twenty-sixth day, it reaches 800 psi, and on the twenty-sixth day, it reaches zero (0).

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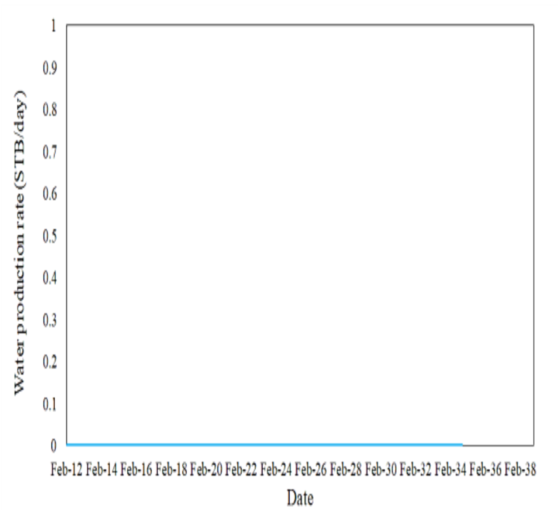
FU-27 Well

Oil production in well number 27 of future wells: has gas production and does not have zero (0) water production.



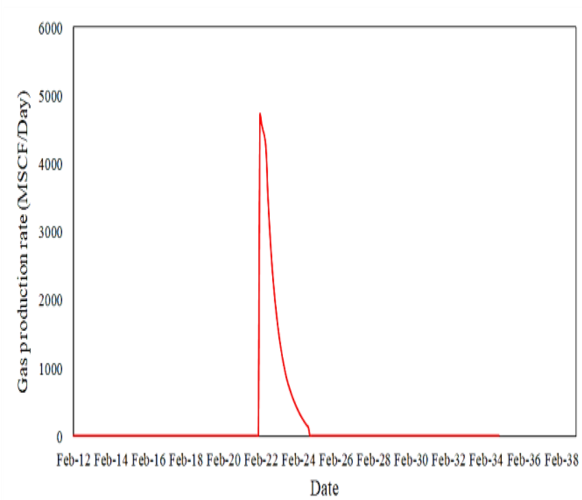
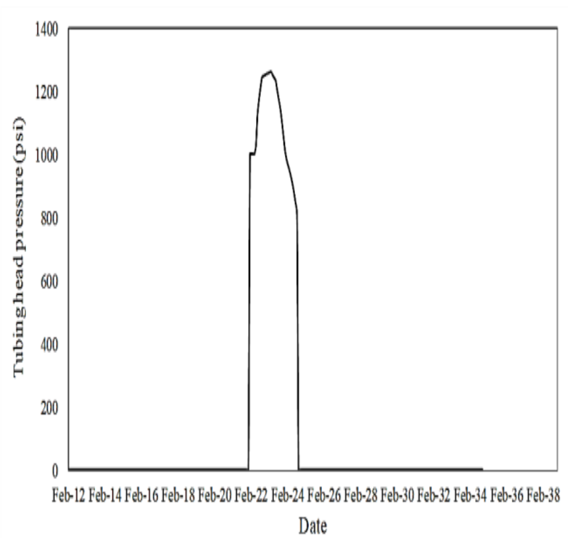


Fig 14: Gas production **Fig 15: Water production**



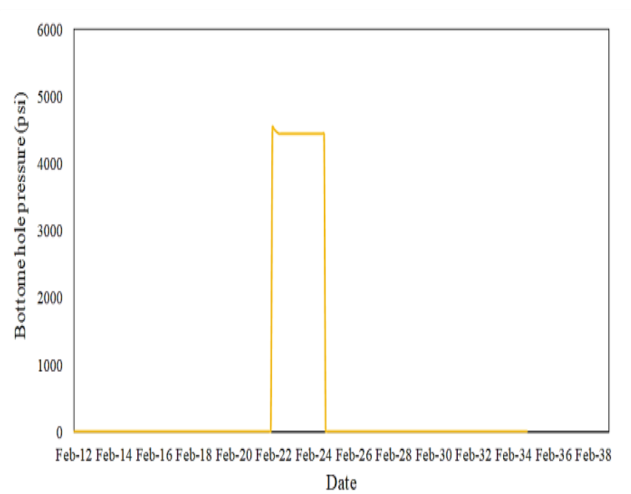


Fig 16: Pressure to the well **Fig 17: Well pressure**

Well No. 27 Future well: The amount of gas in well number 27, which is the next well, reaches more than 4000 psi in its maximum value, and on the twenty-fourth day, the amount of gas drops to its lowest value at the end of the twenty-sixth day. It reaches zero (0) and there is no water in well number 27.

FU-27 Well: Oil production in well number 27 Future well: Well pressure has well pressure

The bottom pressure of the well in well number 27, which is the next well, reaches its maximum value of more than 4000 psi, and on the twenty-fourth day after, the bottom

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well pressure reaches zero (0). On the twenty-sixth day, the well pressure reaches zero (0) at its lowest value.

FU-28Well: Oil production in the next 28 wells:

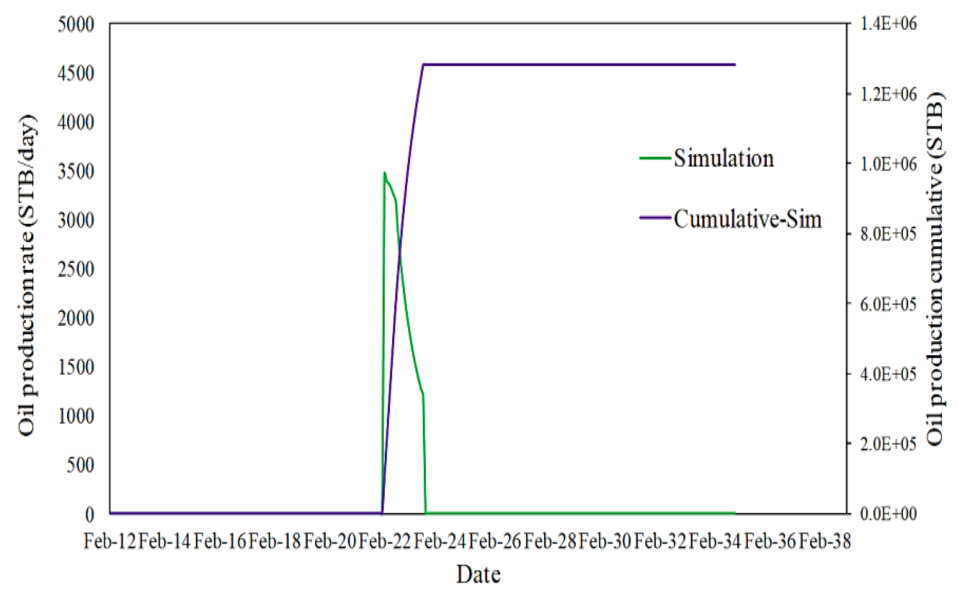

Fig 18: FU-28Well

In well number 28, which is the future well, the amount of cumulative reaches its maximum value, more than 4500 STB / day.

FU-28Well: Oil production in well number 28 Future well: also produces gas and water

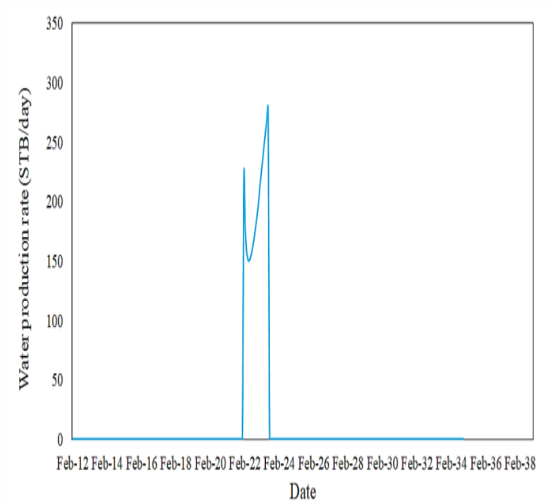

Fig 19: Gas production

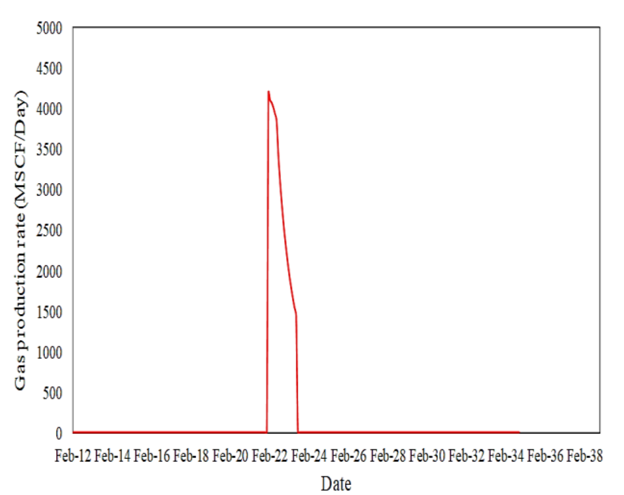

Fig 20: Water production

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Well number 28 Future well: The amount of gas in well number 28, which is the next well, reaches its maximum amount of more than 4000 MCSF / day, and at the end of the twenty-fourth day, the minimum amount reaches more than 1500MCSF / day. In well number 28, which is the next well, reaches 250STB / day, and at its lowest value, the amount of water production in well number 28 reaches more than 200 STB / day at the end of the twenty-second day and finally reaches zero (0).

FU-28Well: Oil production in well number 28 of future wells: well pressure has well pressure

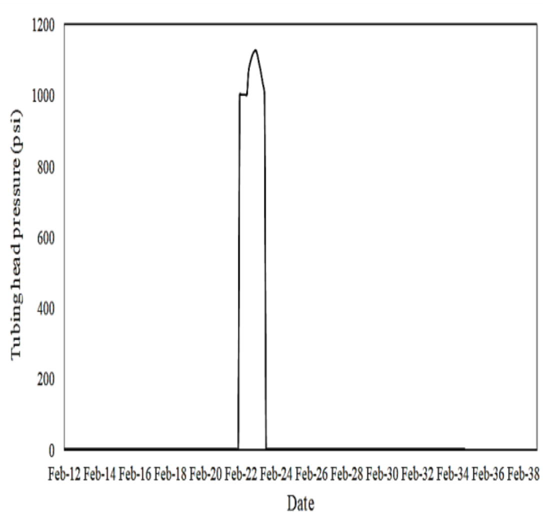

Fig 21: Pressure to the well

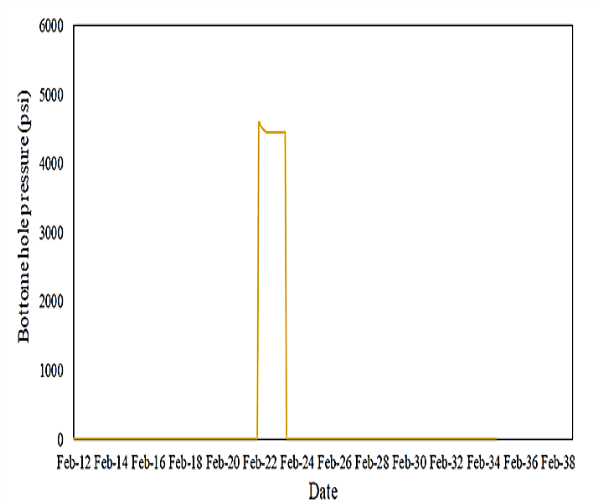

Fig 22: Well pressure

Well pressure, in well number 28, which is the next well, reaches more than 4800 psi at its maximum value on the twenty-second day and at its lowest value reaches less than 4500 psi at the end of the twenty-fourth day. It reaches 1000psi at the end of the twenty-second day.

FU-29Well: Oil production at well number 29 of future wells

In well number 29, which is the next well, the cumulative amount reaches more than 7000 STB / day and the amount of discharge in well number 29, which is the next well, the amount of oil production reaches more than 3000 STB / day and reaches zero (0) at its lowest level at the end of the 26th day.

FU-29 Well: Oil production in well number 29 Future well: Gas production has water production

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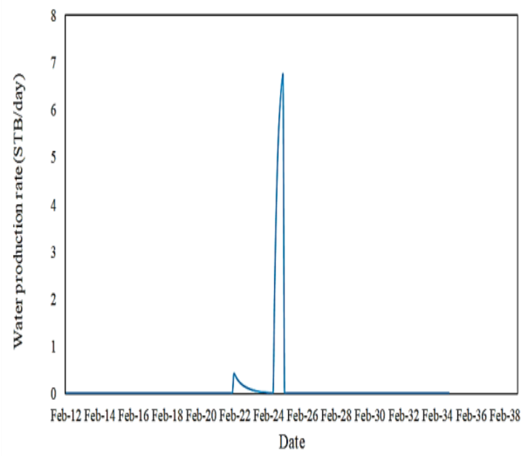

Fig 23: Gas production

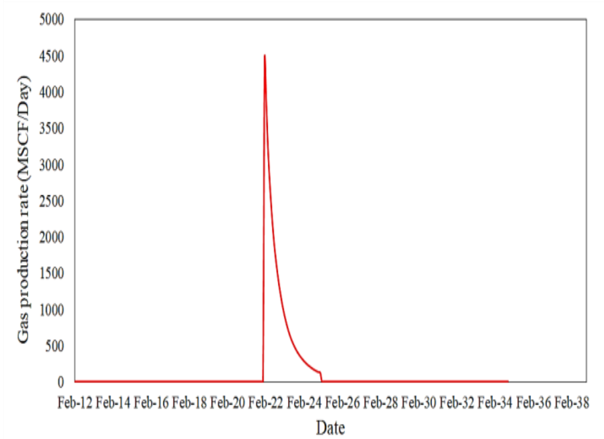

Fig 24: Water production

Oil production in well number 29 of future well: The amount of gas in well number 29, which is the next well, reaches more than 4000 MSCF / day in the maximum amount and 1000MSFF / day in the lowest. At its maximum, water production reaches more than 6 STB / day at the end of the 26th day.

FU-29Well: Oil production in well No. 29 Future well: Well bottom pressure and well pressure

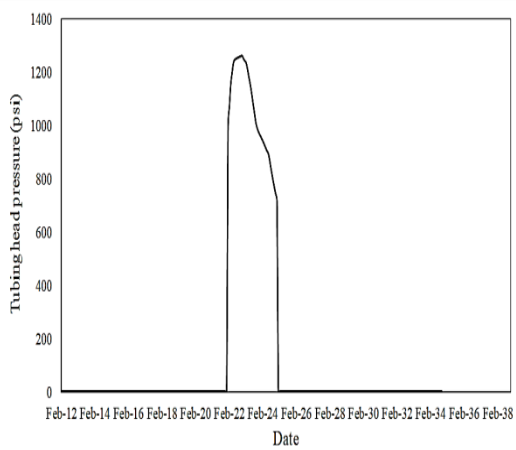

Fig 25: Pressure to the well

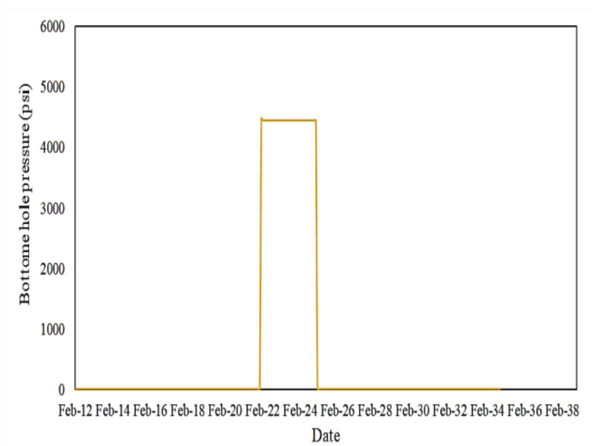

Fig 26: Well pressure

Well pressure, in well number 29, which is the next well, reaches its maximum value of more than 4000 psi, and between the twenty-second and twenty-sixth days, it reaches its maximum value, and on the twenty-sixth day, it reaches zero (0). Well pressure at well number 29, which is the next well, reaches 1200 psi at its maximum and more than 600 psi at its lowest.

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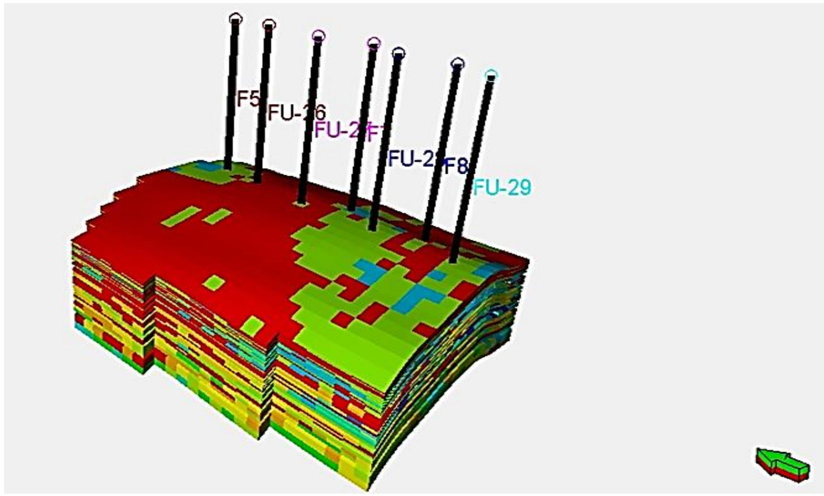

Fig 27: Dubai oil production chart

The flow chart of oil production displays that the reservoir in the current conditions is able to produce oil with a constant flow in wells No. 5, 7, 8 and Hosseinieh well in well No. 5, the bottom pressure of the well reaches more than 8000psi in its maximum value and more than 4000psi in its lowest value.

Twenty-two onwards, the bottom pressure of the well reaches zero (0). In well number 5, the value of the well pressure reaches more than 5000 psi at its maximum and less than 1000 psi at its lowest value. In well number 5, the value of well pressure reaches its maximum value of more than 5000 psi and its minimum value reaches less than 1000 psi. From the twenty-second day onwards, the bottom pressure of the well reaches zero (0). The well indicates the value of 8000psi.

The minimum value is 4000psi. Finally, from the twenty-sixth day, it reaches zero (0). Well pressure in well number 7, at its maximum value to 5000 psi, which during this period decreases to its minimum value to 1000 psi, which from the twenty-sixth day onwards, well pressure in well number 7, reaches zero (0).

There are water ater, oil, gas in Yadavaran oil fields. This reservoir is a three-dimensional static and dynamic one, for which a segmental model has been studied and researched. There is a volume of primary fluid in the reservoir. There are oil production wells in the future wells No. 29, 28, 27, 26. Wells Water injection is also present in this reservoir and has been completed in all layers of the reservoir and will be created for future wells.

After simulating the reservoir model for 794 days: water, oil, gas phases are present in the oil field reservoir. As it is a static and dynamic three-dimensional one, the segmental model has been scrutinized for this purpose. There is a volume of fluid in the initial place in the tank.

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CONCLUSION

1) The graph of gas to oil ratio illustrates that the amount of production is increased from the initial amount as the flow of oil production gets enhanced. However, the ratio of gas to oil can be returned to its original level through reducing the flow of oil production.
2) The production diagram of water production also sindicates that the enhancement of oil production flow subjects to increase the amount of water intake. Contrary to the ratio of gas to oil, decreasing the flow of oil production cannot greatly reduce the cut-off of water production.

References

1) S.H. Begg, R.B. Bratvold, J.F. Campbell, Decision Making under Uncertainty. Paper SPE June presented at the The 7th International Forum on Reservoir Simulation, Buhl/Baden-Baden, Germany, June. (2003).
2) C. Samantha, a.C. Bates, Bayesian uncertainty assessment in multi-compartment deterministic,2003.
3) P. Wang, Development and Applications of Production Optimization Techniques for Petroleum Fields, PhD thesis in Department of Petroleum Engineering, Stanford University, CA.2003.
4) M. Armstrong, A. Galli, W. Bailey, B. Couet, “Incorporating technical uncertainty in real option valuation of oil projects,” Journal of Petroleum Science and Engineering, Vol.44, Issues 1-2, pp. 67-82. (2004).
5) G. Caumon, S.B. Strebelle, J.K. Caers, A.G. Journel, “Assessment of Global Uncertainty, 2004.
6) M.A.G. Dias, “Valuation of Exploration and Production Assets an Overview of Real Options, 2004.
7) V. Goel, I.E. Grossmann, “A Stochastic Programming Approach to Planning of Offshore Gas Field Developments Under Uncertainty in Reserves,” Computers and Chemical Engineering, Vol. 28, pp. 1409-1429. (2004).
8) D. Hastings, H. McManus, "A Framework for Understanding Uncertainty and its Mitigation Dissertation, department of Petroleum Engineering, Stanford University, CA. (2004).
9) S.B. Suslick, D.J. Schiozer, “Risk Analysis Applied to Petroleum Exploration and Production An Overview”,Journal of Petroleum Science and Engineering,Vol. 44, No 2, pp.1-9. (2004).
10) I. Zabalza. Mezghani, E. Manceau, M. Feraille, A. Jourdan, “Uncertainty Management: From Geological Scenarios to Production Scheme Optimization,” Journal of Petroleum Science and Engineering, Vol. 44, Issue 1-2 pp. 11- 25. (2004).
11) A. Mira, Introduction to Monte Carlo and MCMC methods. University of insubria, varese, italy , 21-24, june 2004.
12) E.L. Ligero, M.G. Madeira, D.J. Schiozer, “Comparison of Techniques for Risk Analysis Applied to Petroleum Field Development,” SPE94806, Latin American and Caribbean Petroleum Engineering Conference, 20 -23 June, Rio de Janeiro, Brazil. (2005).
13) L. Feyen, J. Caers, "Quantifying geological uncertainty for flow and transport modeling in multi-modal heterogeneous formations", Adv. Water Resour., 29, 912–929, doi: 10.1016/j.advwatres. (2006).
14) Exploitation in Complex Systems", Engineering Systems Symposium, March 29-31, MIT, Cambridge, MA.
15) P. Sarma, “Efficient Close-Loop Optimal Control of Petroleum Reservoirs Under Uncertainty,” PhD Dissertation in Department of Petroleum Engineering, Stanford University, CA. (2006).

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DOI: 10.5281/zenodo.10318281

16) K. Rezaie, Using extended monte carlo simulation method for the improvement of risk management: consideration of relationships between uncertainties. Applied mathematics and computation ,2007.

17) Course notes from Shell Phase 2 Production Geology course.Shell Internationale petroleum Maatschappij BV (SIMP) Training Division,1986.

18) S.H. Deguchi Hayashi, E.L. Ligero, D.J. Schiozer, “Decision-Making Process in Development of Offshore Petroleum Fields”, SPE 107737, Latin American & Caribbean Petroleum Engineering Conference, 15-18 April 2007, Buenos Aires, Argentina, Society of Petroleum Engineers.

19) Basic Petroleum Geology, Second Edition. OGCI Publications, 1982 Tulsa, OK.425.

20) M. Houwing, A.N. Ajah, P.M. Herder, I. Bouwmans, “Addressing Uncertainties in the Design and Operation of Residential Distributed Energy Resources: Case study of a Micro-CHP System”, In Proceedings of the Chemical Engineering Transactions XII on the 10thConference on Process Integration, Modelling and Optimization for Energy Saving and Pollution Reduction, pp. 1-8, June 24-27, Ischia, Naples, Italy. (2007).

21) K. Rezaie, Using extended monte carlo simulation method for the improvement of risk management: consideration of relationships between uncertainties. Applied mathematics and computation . Environmetrics , 355–371. (2007).

22) E.A. Addiego-Guevara, M. D. Jackson, M. A. Giddins “Insurance Value of Intelligent Well Technology against Reservoir Uncertainty.” SPE/DOE Symposium on Improved Oil Recovery. Tulsa, Oklahoma. (2008).

23) J.E. Bickel, R.B. Bratvold, from uncertainty quantification to decision-making in the oil and gas industry, Energy Exploration & Exploitation 26(5):311-325. (2008).

24) Early Appraisal of Hydrocarbon Fields”, SPE Annual Technical Conference and Exhibition, Houston, Sept. 26 – Sept 29, 2004.

25) Uncertainty”, PhD Dissertation, Department of Petroleum Engineering, Stanford University, CA.2009.

26) C. Scheidt, J. Caers, Uncertainty quantification in reservoir performance using distances and kernel methods – application to a West-Africa deep water turbidite reservoir. Society of Petroleum Engineers Journal, 14 (4):680:692, SPEJ 118740-PA. (2009).

27) W.F. Skljerman, J.P. Hoffman, Determination of Surface Relaxivity from NMR Diffusion Measurements. Magnetic Resonance Imaging 16 (June-July):541-544. (1988).

28) "The reservoir engineering aspects of water flooding", Monograph series, SPE, Texas, USA, 1971.

29) "ECLIPSE 100 user course ", schlumberger Geoquest. 1999.

30) 'ECLIPSE black oil reservoir simulation, Training and exercise guide”, schlumberger Information Solution. 2005.

31) J.R. Fanchi, 'Principles of Applied Reservoir Simulation", third edition, Gulf Professional Publishing, USA, 2006.

32) D.W. Green, G.P. Willhite, “Enhanced oil recovery", SPE, Taxas, USA, 1998.

33) J. Kleppe, "Reservoir Simulation ", Course material, Norwegian university of science and technology, 2010.

34) A.S. Odeh, “Comparison of solutions to a three-dimensional black – oil reservoir simulation problem", Journal of petroleum technology, 33(1), 13-25. (1981).

35) D.W. Peaceman, "Fundamentals of numerical reservoir simulation" Elsevier scientific publishing company, 1977 Netherlands.

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ISSN: 1671-5497
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DOI: 10.5281/zenodo.10318281

36) "Basics of Reservoir Simulation with the ECLIPSE Reservoir Simulator: Lecture Notes", University of Bergen, Department of Mathematics, Bergen, 2006 Norway.

37) Schlumberger ECLIPSE," ECLIPSE Floviz user guide 2009.1", Schlumberger.

38) Schlumberger ECLIPSE, “ECLIPSE office user guide 2009.1", Schlumberger.

39) Schlumberger ECLIPSE, “ECLIPSE reference manual 2009.1", Schlumberger.

40) Schlumberger ECLIPSE, “ECLIPSE technical description 2009.1", Schlumberger.

41) M. Valjak, D. Novakovic, Z. Bassiouni, "Water flooding of depleted volumetric gas reservoirs as a management option to hydrocarbon fields", SPE 69651 presented at LACPEC, Buenos Aires, Argentina. (2001).