

Performance Analysis

Performance analysis is a fundamental component of reservoir engineering, aimed at evaluating the production behaviour of oil and gas reservoirs over time. By systematically studying production rates, injection profiles, reservoir pressure variations, and fluid characteristics, performance analysis helps in understanding the dynamic response of a reservoir to depletion and recovery processes. It also plays a critical role in identifying opportunities for improving reservoir management, optimizing hydrocarbon recovery, and planning enhanced oil recovery (EOR) projects.

This section presents a comprehensive performance analysis of the studied oil field, utilizing historical production and injection data gathered over several decades. Production from the field began in 1968 under primary depletion mechanisms. As reservoir pressure declined and production rates decreased, water injection was initiated in phases to support reservoir pressure and improve recovery. Over time, various wells were converted from producers to injectors to optimize the water injection strategy. The analysis focuses on production trends, water cut behaviour, reservoir pressure decline, and the impact of water injection schemes.

To visualize and interpret the field's performance, several graphs have been generated using **Microsoft Excel**. These include oil and water production versus time plots, cumulative production graphs, gas-oil ratio (GOR) trends, water cut variations, and injection rate profiles. The graphical representations help highlight key phenomena such as water breakthrough, production decline patterns, and reservoir pressure responses to injection activities.

Through this analysis, the report aims to provide a clear understanding of the reservoir's historical performance, evaluate the effectiveness of past water injection schemes, and assess the potential for further recovery improvements. The findings are intended to support future decision-making regarding reservoir development strategies, including potential EOR applications.

Methodology:

- *Data Collection:* Compilation of historical production, injection, and pressure data.
- *Data Organization:* Chronological arrangement of field-wise and well-wise data.
- *Graph Preparation:* Graphs generated using Microsoft Excel for visualization and trend recognition.

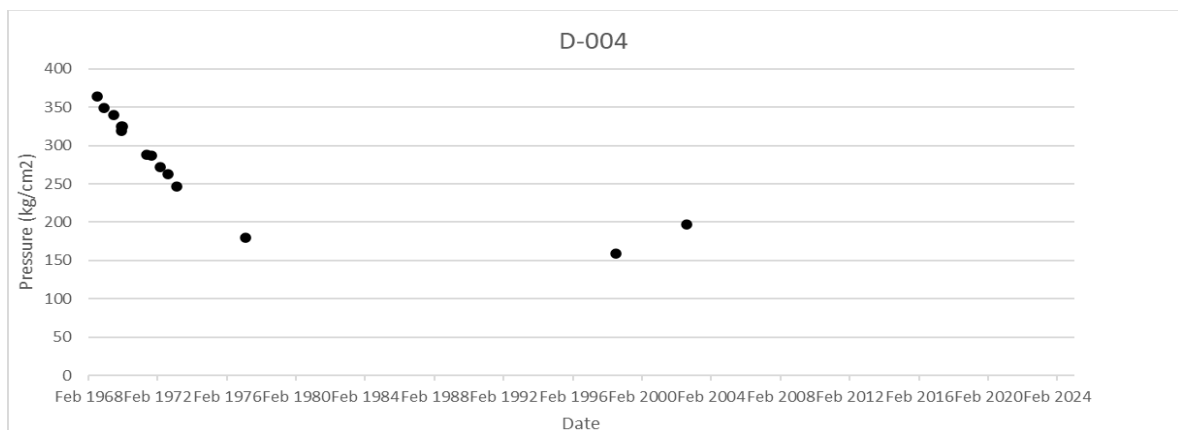
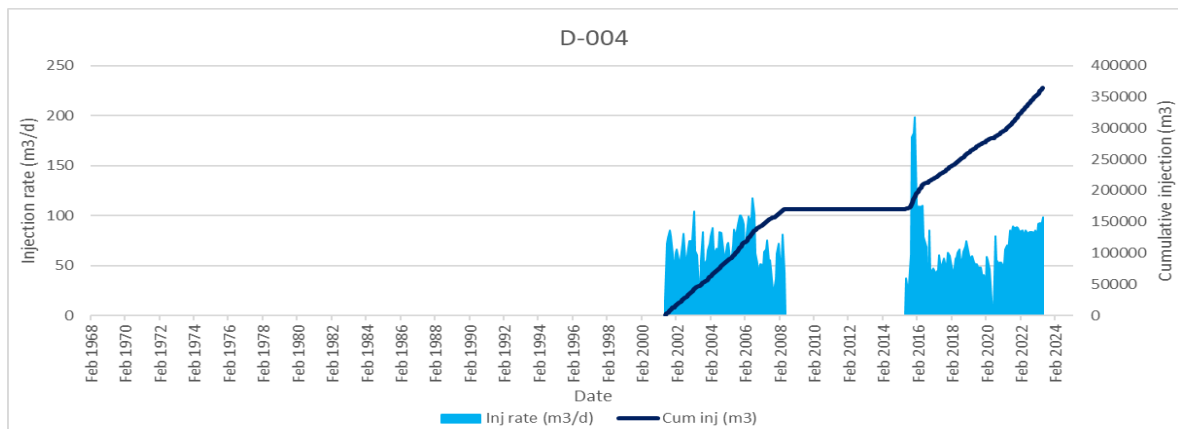
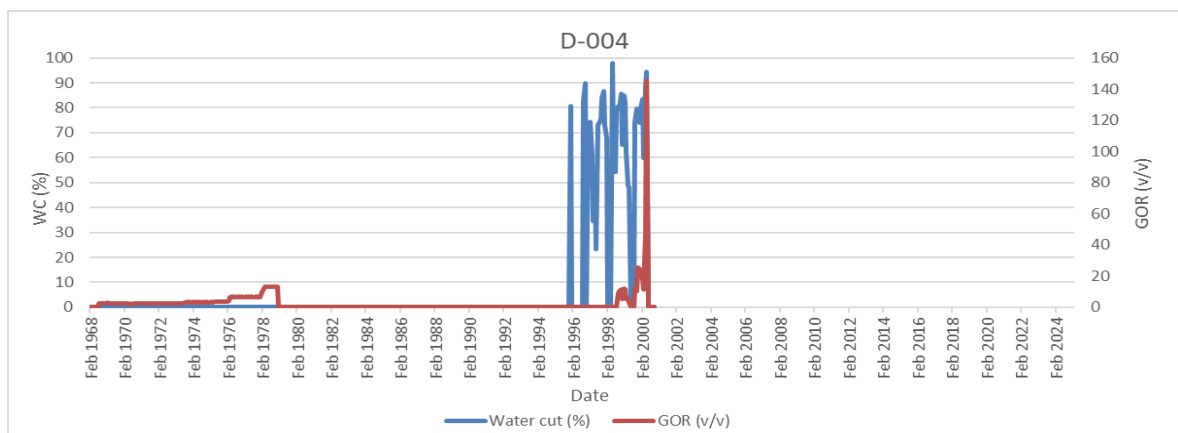
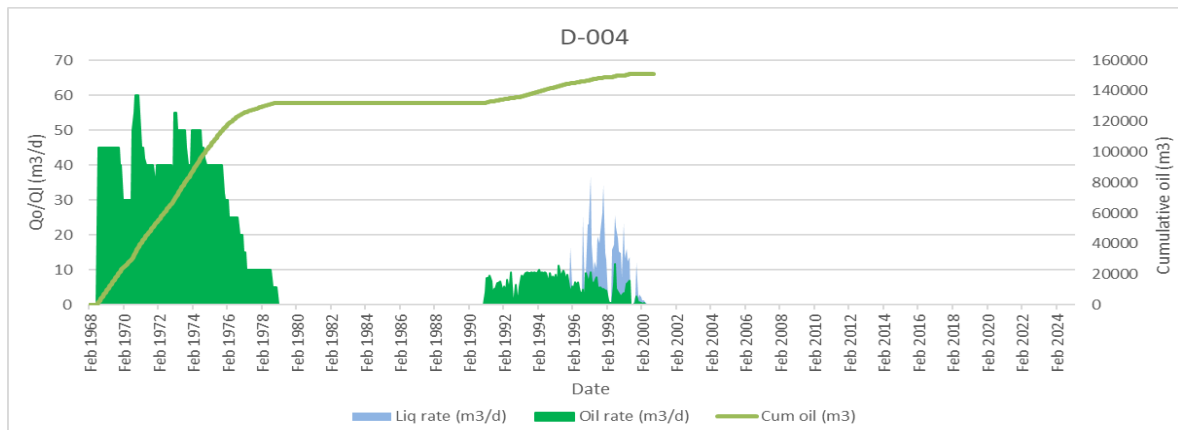
- *Trend Analysis*: Interpretation of production and injection trends to understand reservoir behaviour.
- *Result Compilation*: Summarization of observations to support analysis and recommendations.

Types of Plots Used:

- Oil Production vs. Time
- Liquid Production vs. Time
- Cumulative Oil Production vs. Time
- Gas-Oil Ratio (GOR) vs. Time
- Water Cut (%) vs. Time
- Injection Rate vs. Time
- Cumulative Water Injection vs. Time
- Reservoir Pressure vs. Time

The following sections present a detailed discussion of the graphs prepared for both individual wells and the entire field. Each graph has been analysed to interpret the production behaviour, injection performance, and reservoir response, with specific attention given to identifying key trends such as water breakthrough, changes in gas-oil ratio, and variations in reservoir pressure over time. The interpretations for individual wells are provided first, followed by a comprehensive analysis of the field.

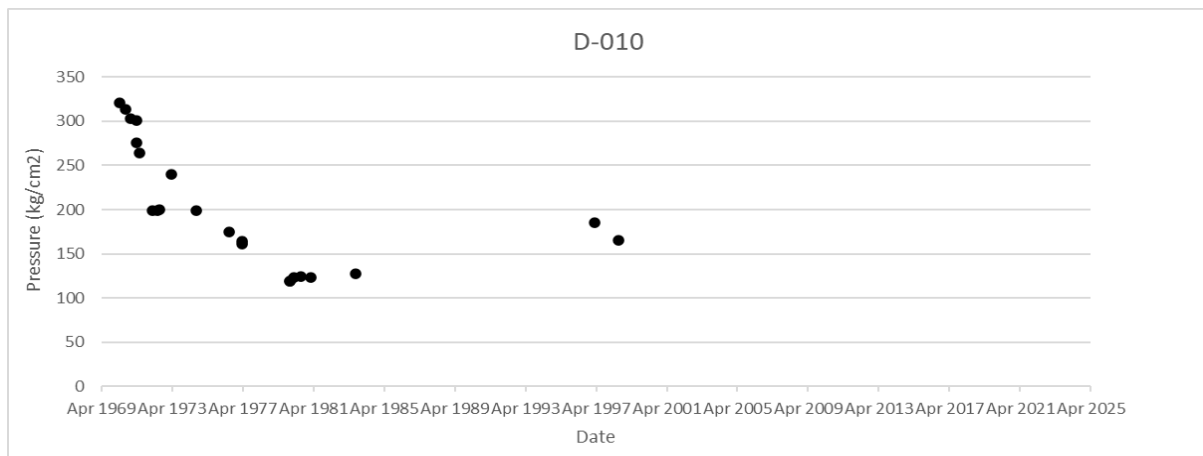
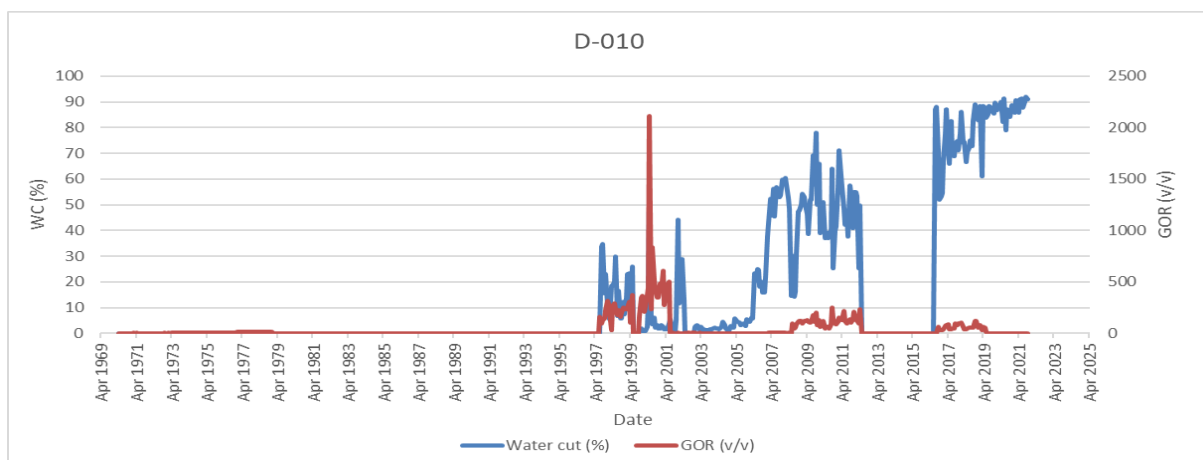
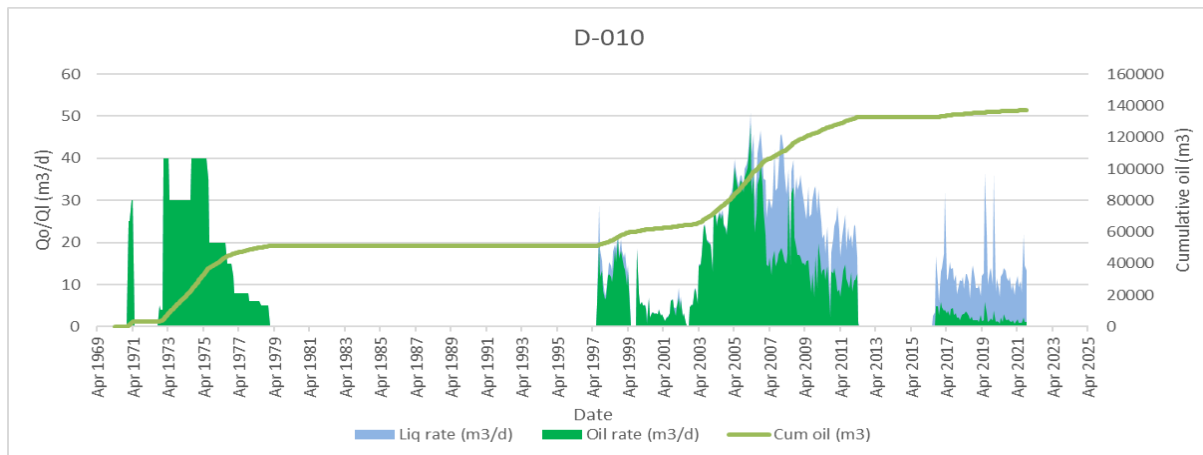
D-004:



Interpretations:

1. The production started in August 1968 with the initial flow rate of 45 m³/d
2. For the first 10 years (1968-1978)
 - Production was good as the flow rate approached 60 m³/d and then declined
 - No water produced during this time
 - Pressure depleted significantly from 364 to 180 kg/cm²
 - GOR touched 20 v/v at the end of this period
3. The well was closed for next 12 years (1978-1991) due to pressure depletion
4. Production was revived by water injection through well D-048
5. After starting the production again
 - Water cut increased and reached almost 100%
 - GOR also spiked at the end reaching 150 v/v from around 20 v/v
6. Total production through this well was 151024.4 m³
7. Around 2001 well was converted to injector and injection was started and pressure increased in almost 2 years from 159.38 to 197.30 kg/cm²
8. Injection was also stopped in 2008 and again started in 2015
9. Total injection through this well was 364159 m³

D-010:

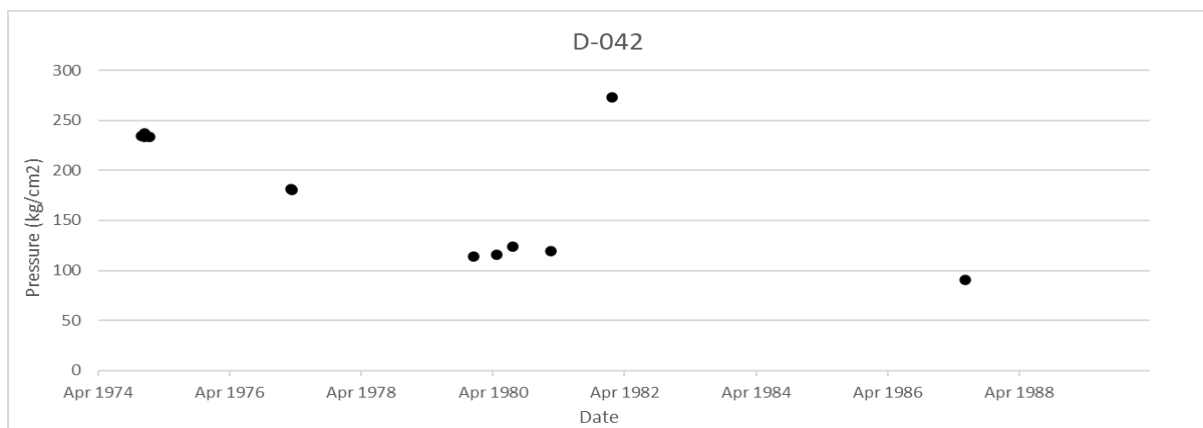
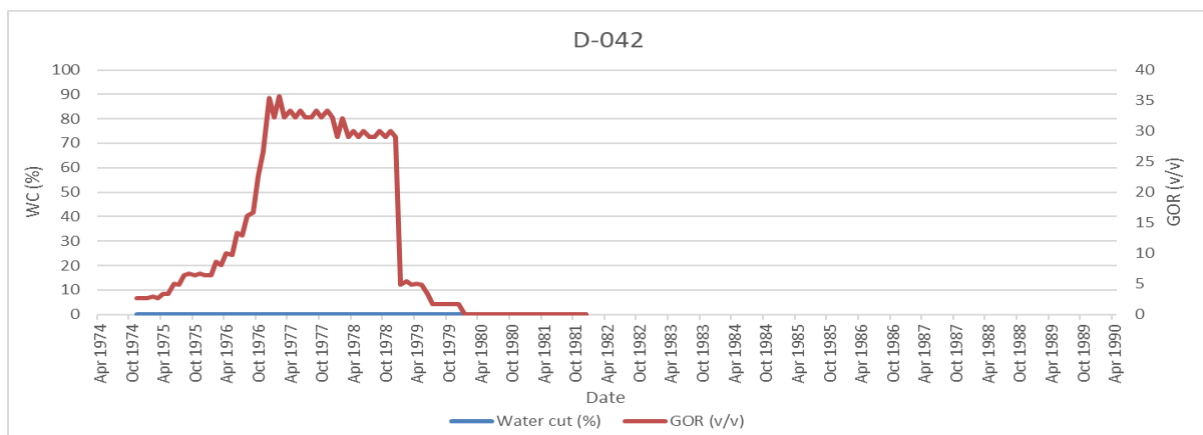
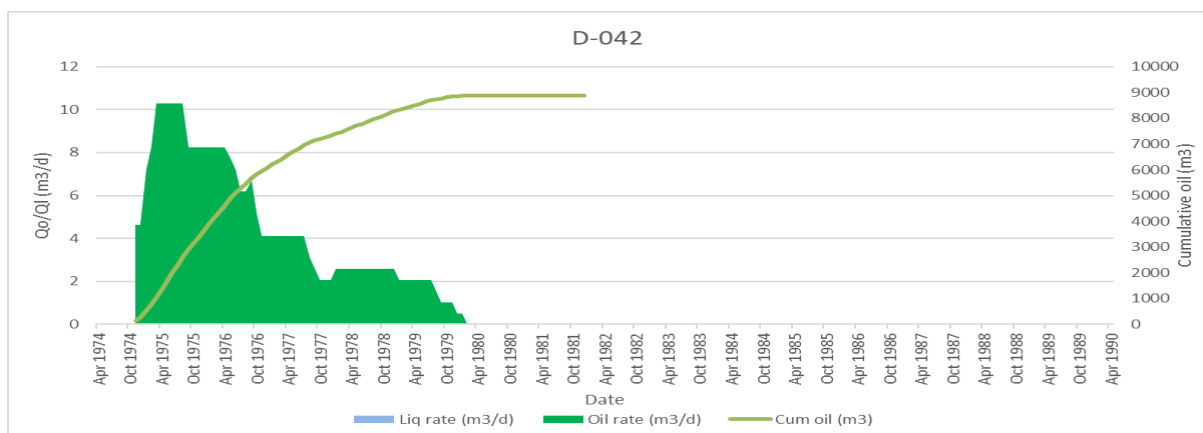


Interpretations:

1. The production started in January 1971 with an initial flow rate of 25 m³/d
2. For the first 10 years (1969-1979)
 - Production was good as the flow rate approached 40 m³/d and then decreased

- No water produced during this time
 - Pressure depleted significantly from 321.14 to 118.85 kg/cm²
3. The well was closed for next 20 years (1979-1997) due to pressure depletion which increased from 118.85 to 184.84 kg/cm² during closure
 4. After starting the production again
 - Water cut increased and reached almost 90% towards the end
 - GOR also spiked in 2000 reaching to 2000 v/v
 5. Total production through this well was 137110 m³

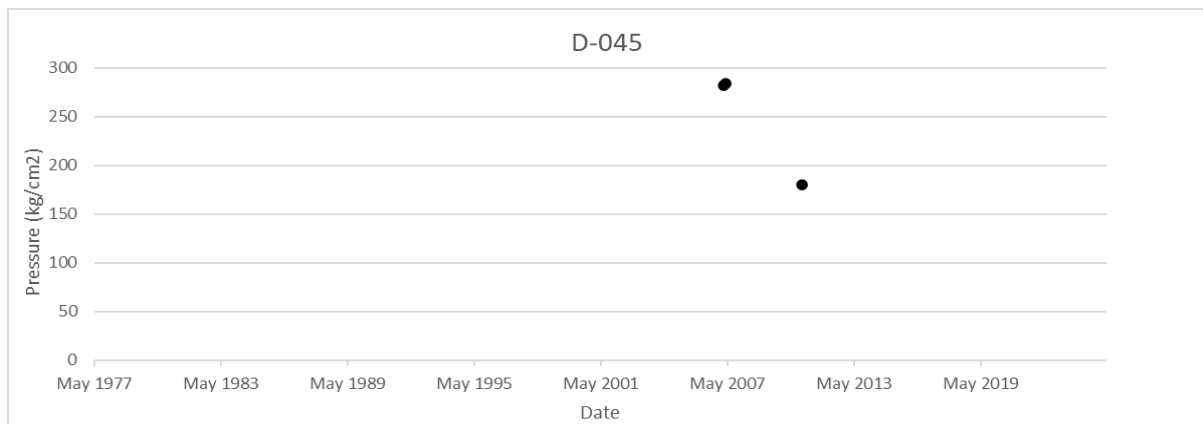
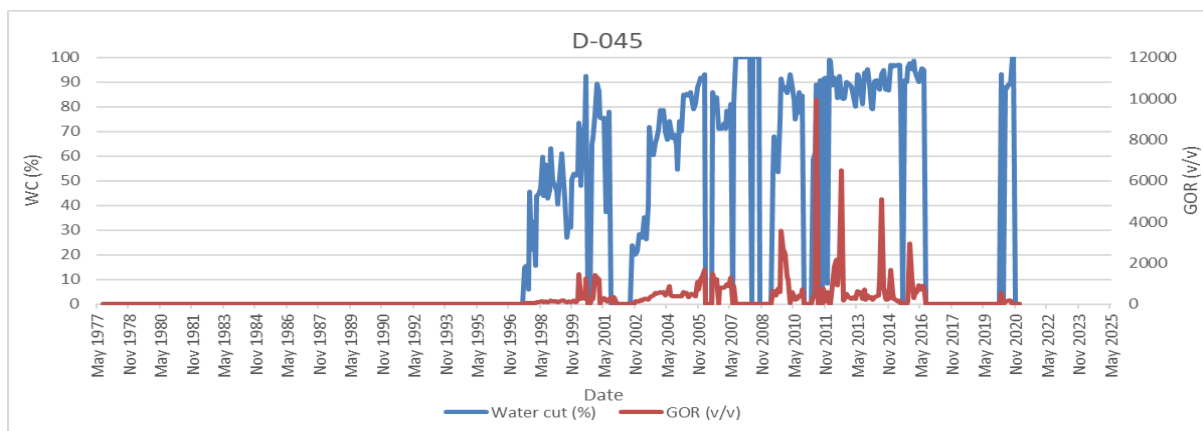
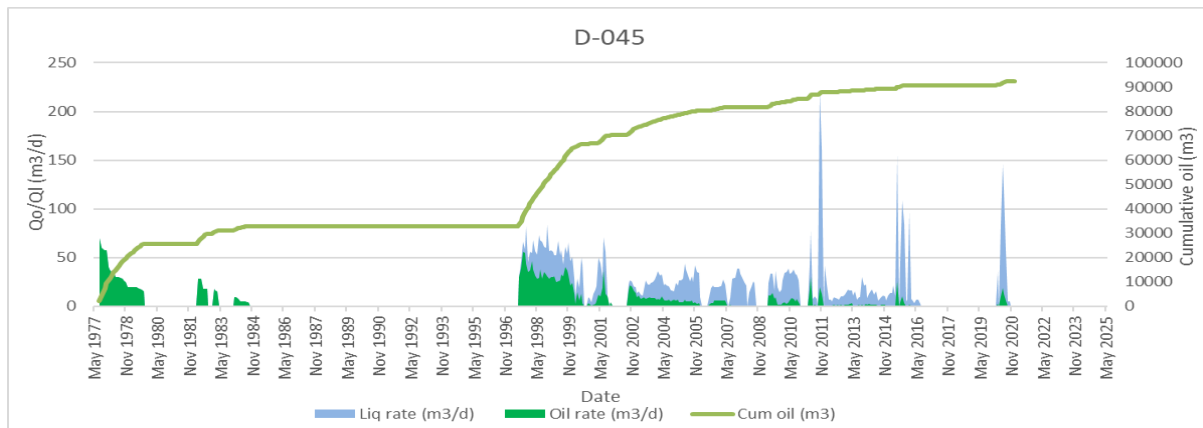
D-042:



Interpretations:

1. The well started producing in November 1974 with an initial flow rate of 4.63 m³/d
2. The well produced for only 6 years and the production was less when compared to others reaching a maximum of 10.3 m³/d
3. No water produced throughout the production period
4. Pressure declined during the production from 234.16 to 113.75 kg/cm²
5. GOR was less than 35 v/v indicating very less gas production
6. There was a sudden increase in pressure of the well in 1982
7. Total production through this well was 8871.39 m³

D-045:

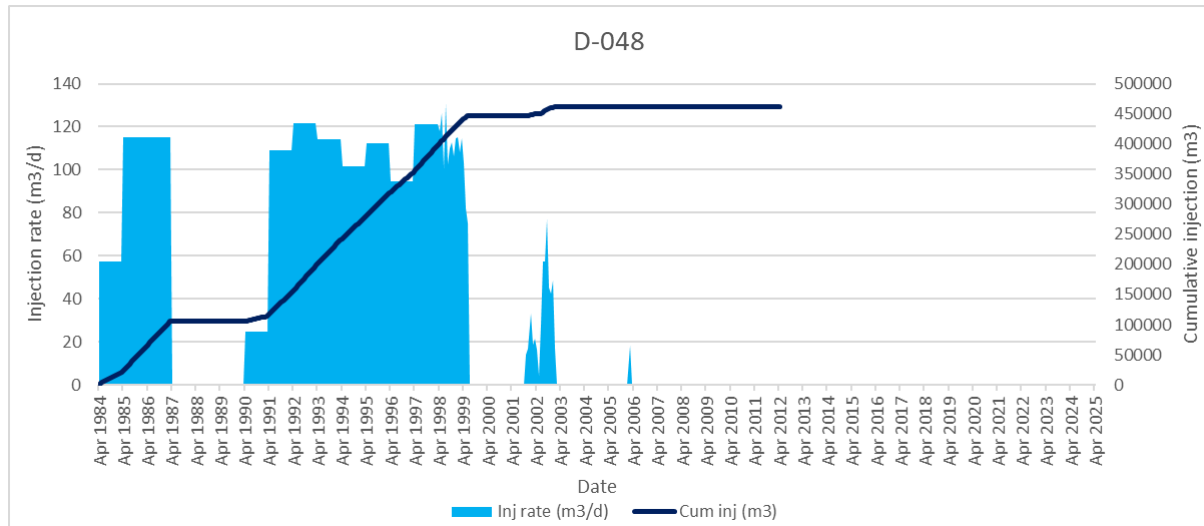


Interpretations:

1. The well started producing in August 1977 with an initial flow rate of 70 m³/d
2. Produced till 1979 then stopped producing for 4 years and again started production for 3 more years
3. The well was closed for 12 years (1984 - 1996)
4. Started producing again in 1996 with
 - High flow rate reaching up to 55.76 m³/d

- Water cut gradually reaching 100 %
 - Pressure decreased from 283.54 to 180.53 kg/cm²
5. The well was closed once water breakthrough occurred in 2020
 6. Total production through this well was 92380.1 m³

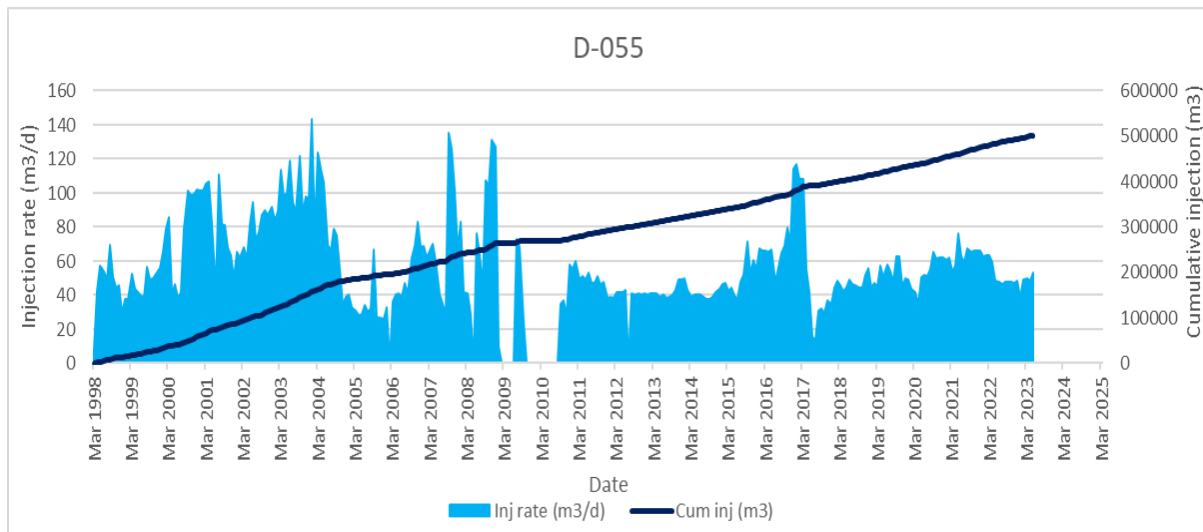
D-048:



Interpretations:

1. Injection started in April 1984 with initial injection rate of 57.53 m³/d
2. Injection rate was further increased after 1 year
3. In 1987 injection was stopped
4. The well again resumed in 1990 with injection rate of 24.63 m³/d which was increased to 109 m³/d within a year
5. Injection was finally stopped in 2006
6. The maximum injection rate through this well was 130.42 m³/d
7. This injection well increased the average pressure in the reservoir increasing the flow through other wells
8. Total injection into the reservoir through this well was 461940 m³

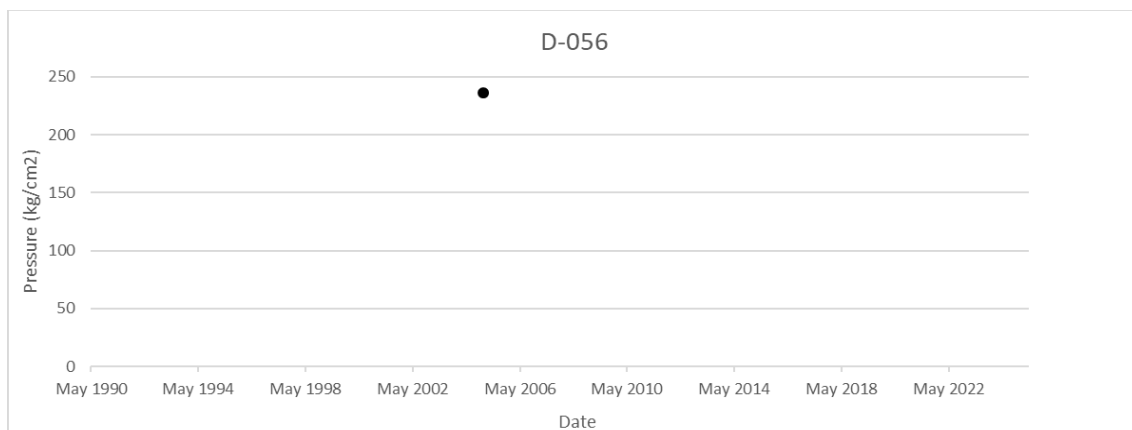
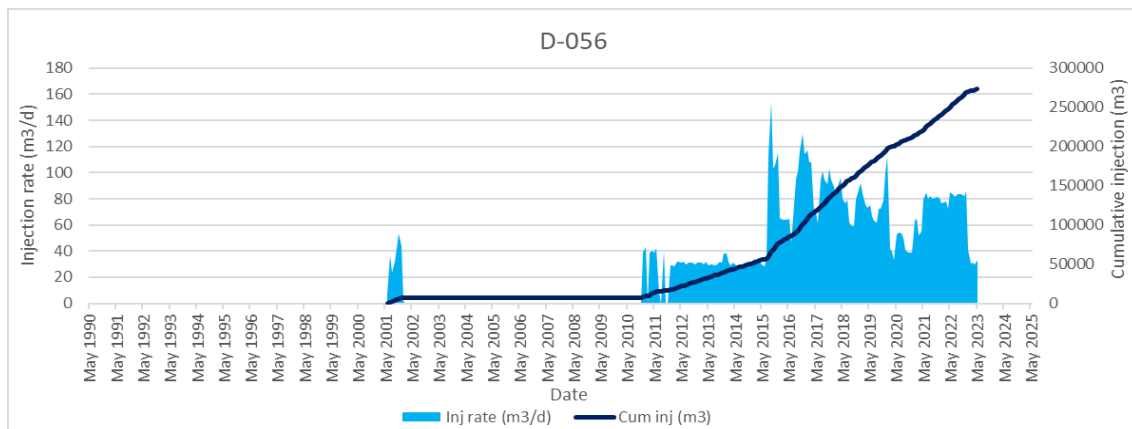
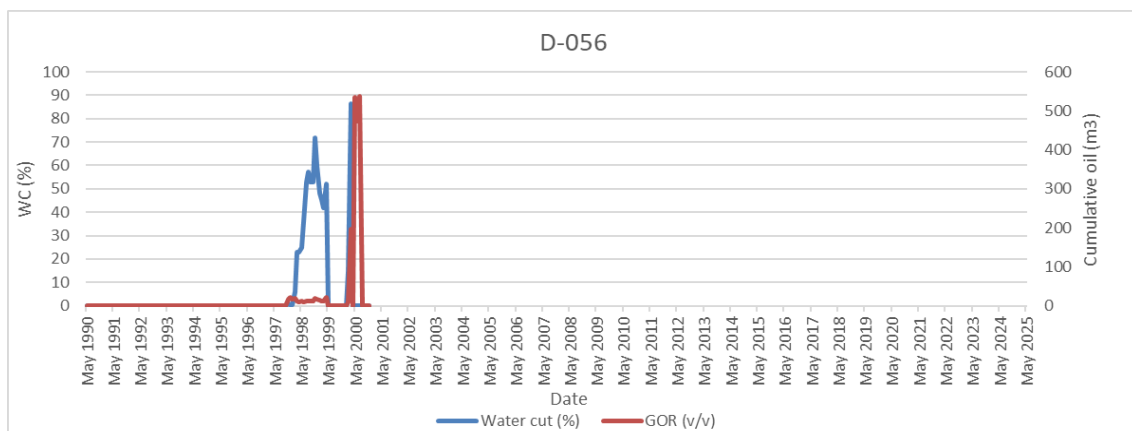
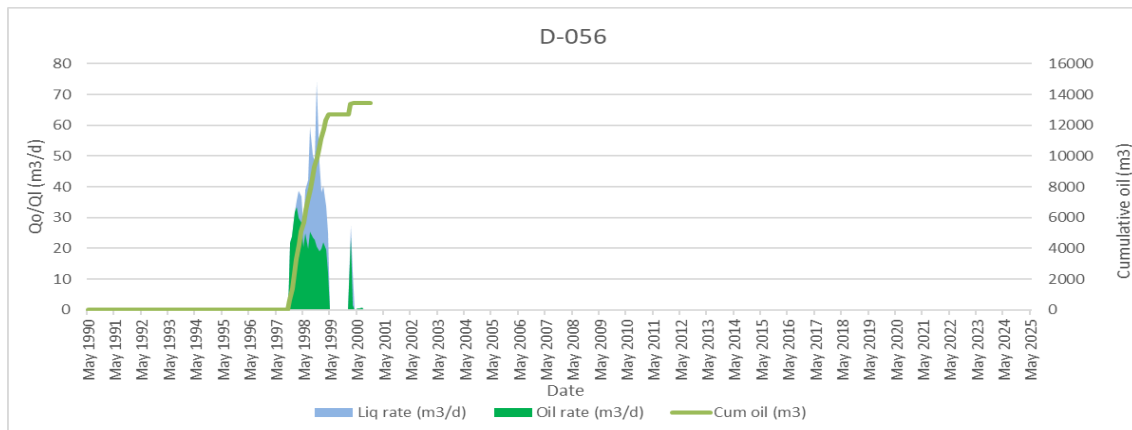
D-055:



Interpretations:

1. Injection through this well was started in March 1998 with an injection rate of 7.74 m³/d which increased to 42.26 m³/d in the next month
2. The injection continued till 2023
3. The maximum injection rate was 143.23 m³/d
4. Injection rates throughout the injection period were varying
5. Total injection through this well was 501528 m³

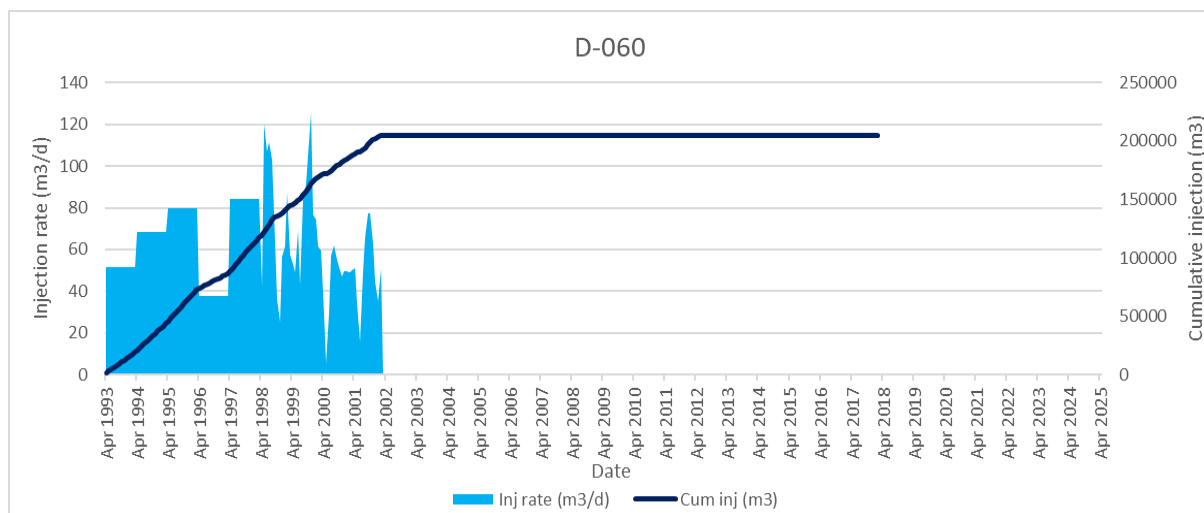
D-056:



Interpretations:

1. The well started producing in November 1997 with an initial flow rate of 21.67 m³/d
2. Water cut reached almost 90 % in year 2000
3. The well produced for 3 years and then it was converted to injector
4. The injection through the well was started in June 2001 and the initial injection rate was 7.56 m³/d and varied over the years
5. The injection was stopped in January 2002 and again started in December 2010
6. Total injection through this well was 273531 m³

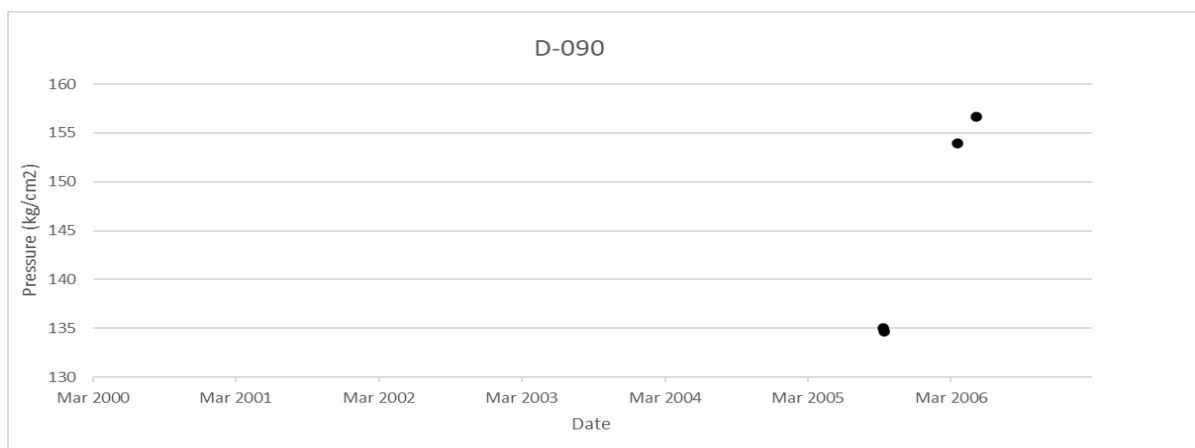
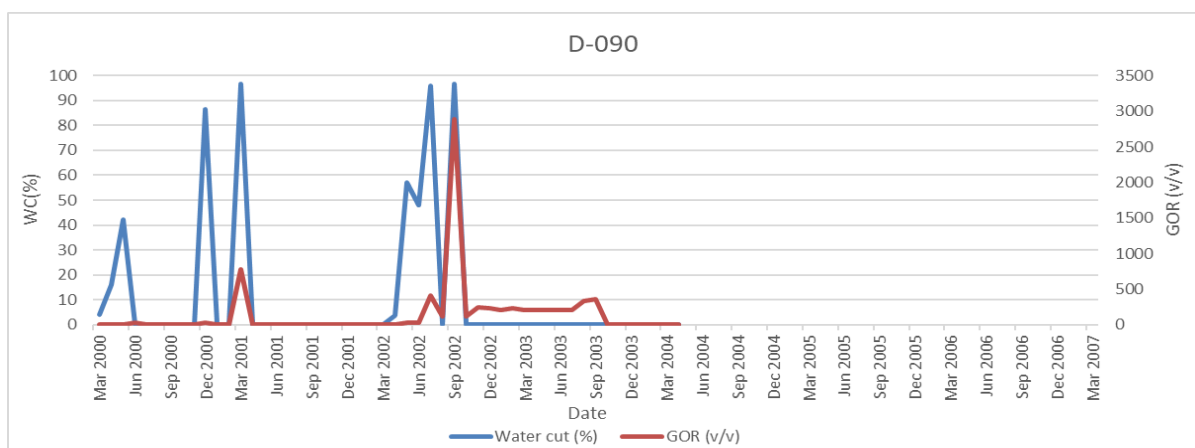
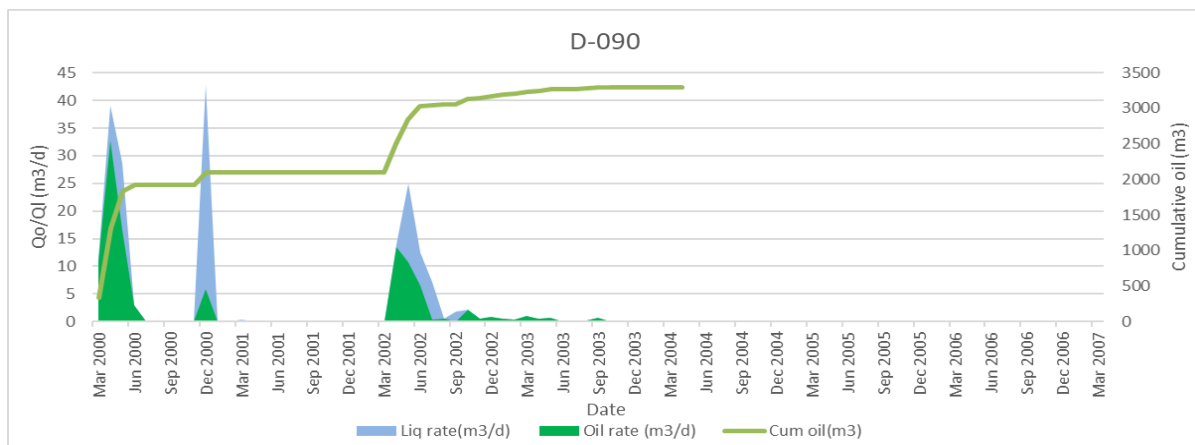
D-060:



Interpretations:

1. Injection started in April 1993 with an injection rate of 51.4 m³/d
2. The injection rate was increased reaching to a value of 79.6 m³/d
3. The maximum injection rate from this well was 125.3 m³/d
4. The injection was stopped in March 2002
5. Total injection through this well was 204806 m³

D-090:

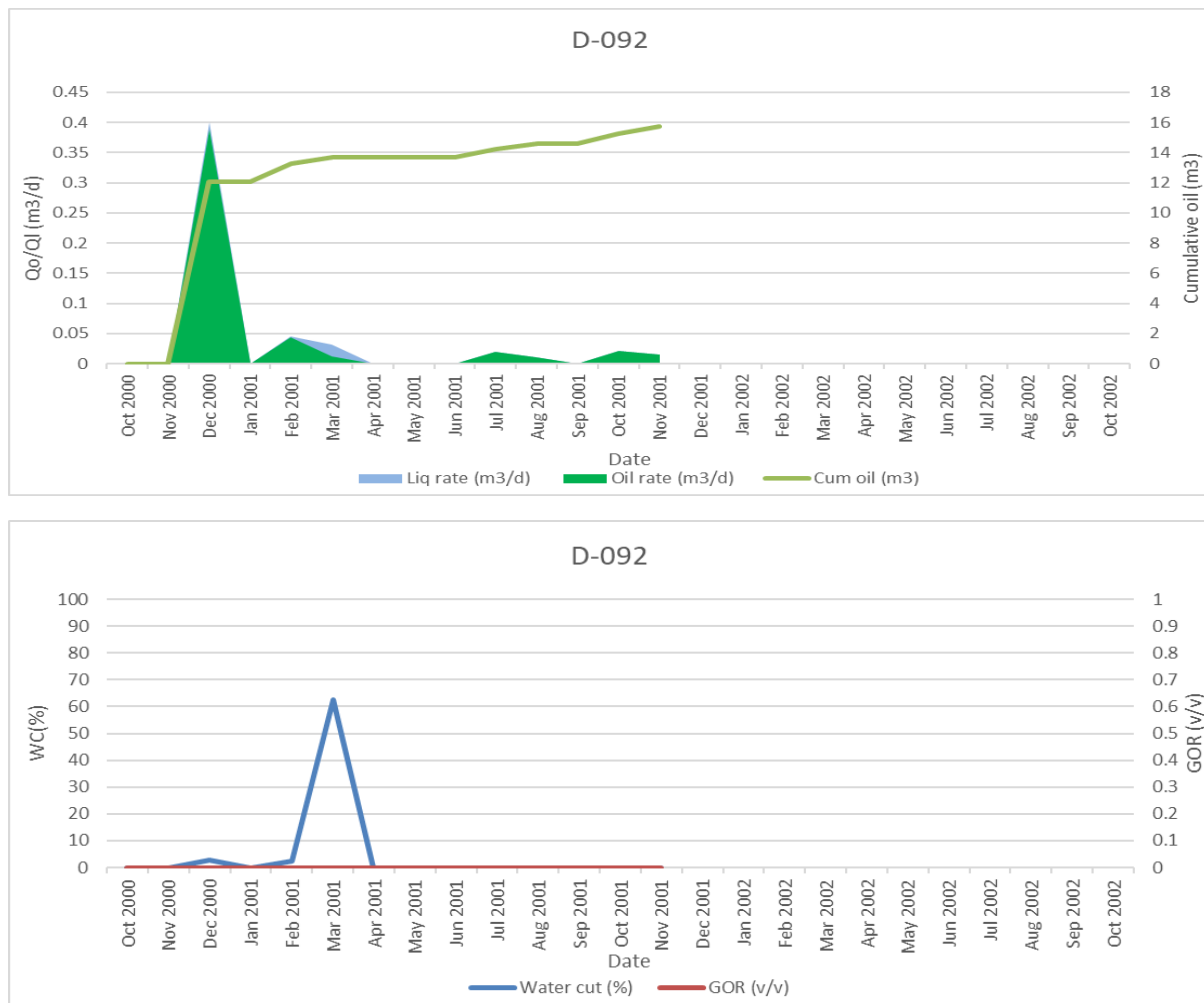


Interpretations:

1. The well started producing in March 2000 with an initial oil flow rate of 10.95 m³/d
2. The well is producing water from the beginning
3. The well produced for 4 months then stopped for 5 months and again started producing for 1.5 years till September 2003

4. Water cut through this well reached almost 97 %
5. After closing the well pressure was recorded which increased from 135.01 to 156.63 kg/cm²
6. Total production through this well was 3300.81 m³

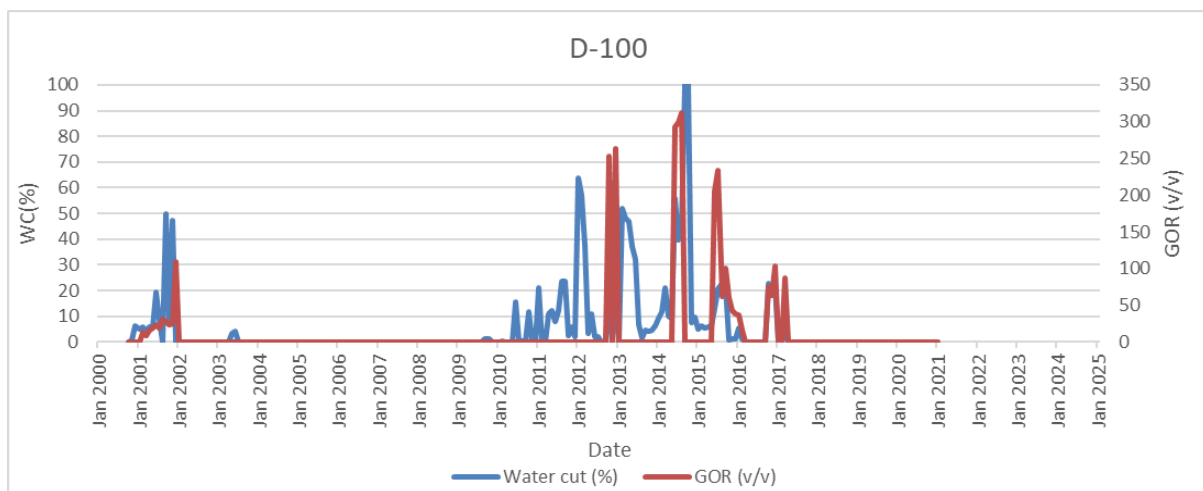
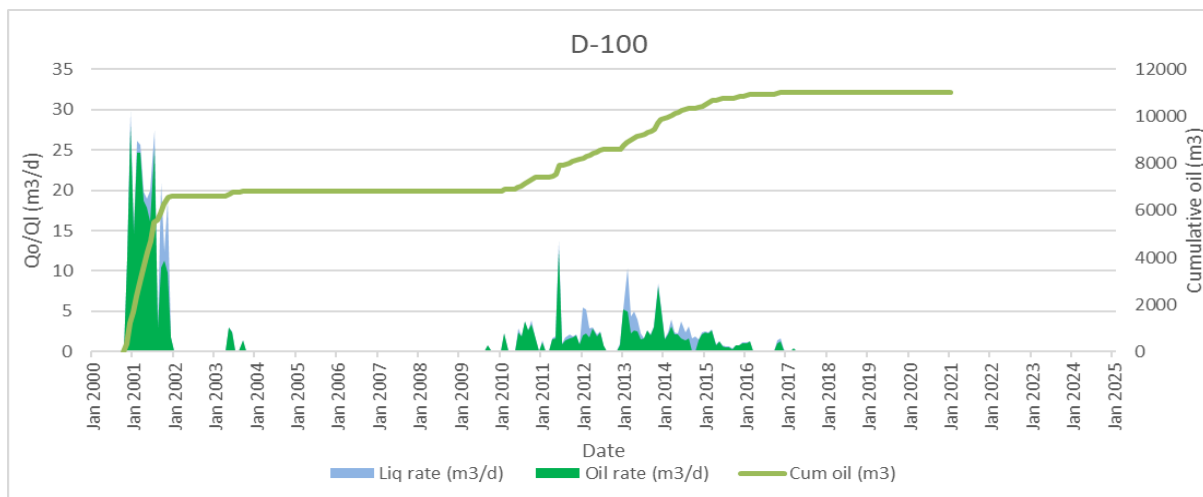
D-092:



Interpretations:

1. The well started production in December 2000 with the maximum initial flow rate of 0.39 m³/d
2. Water cut reached about 63 %
3. The production stopped in November 2001
4. No gas was produced throughout the production
5. Total production through this well was 15.708 m³

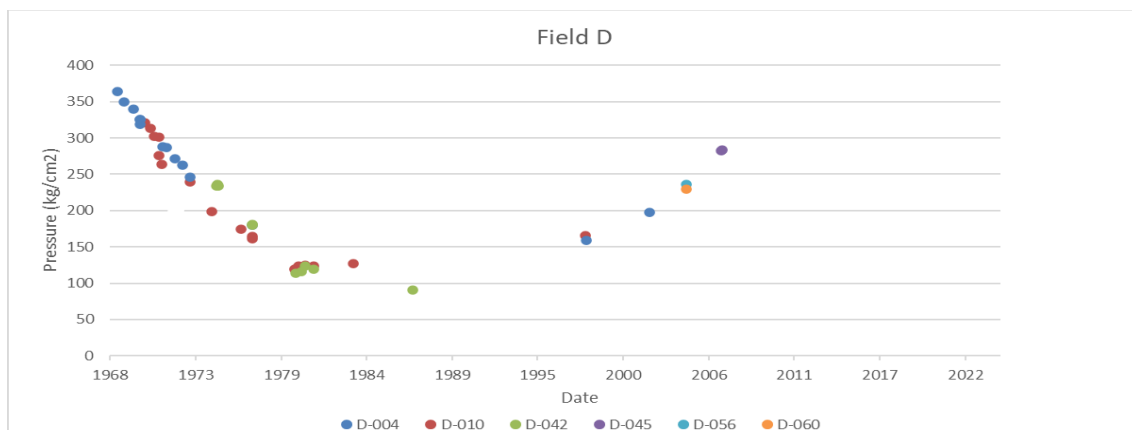
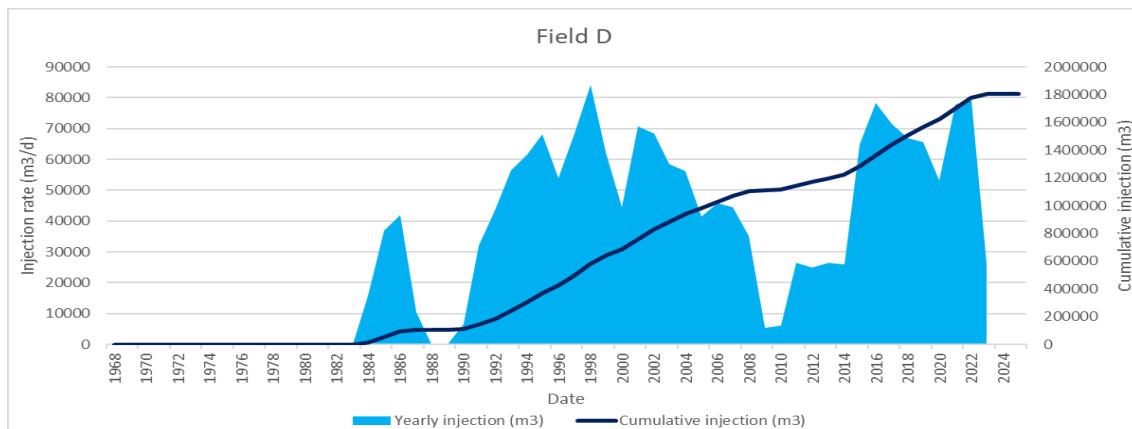
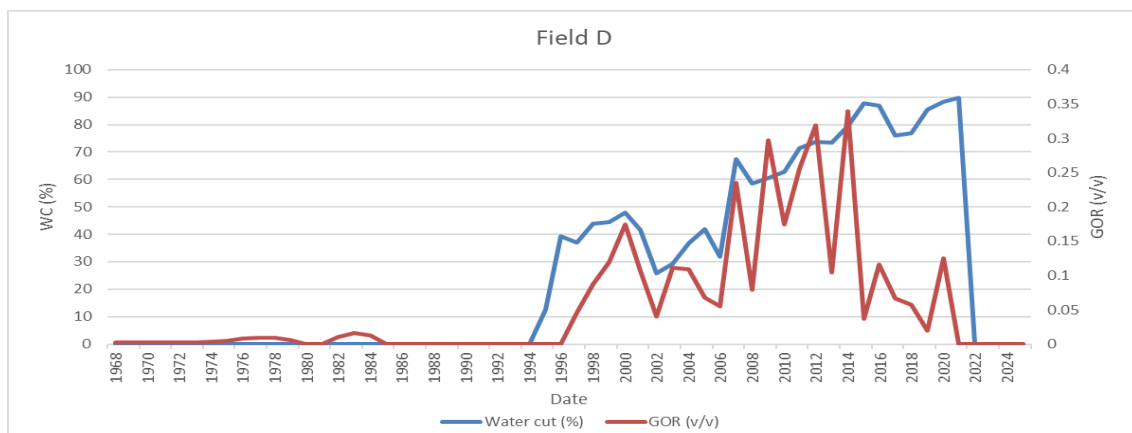
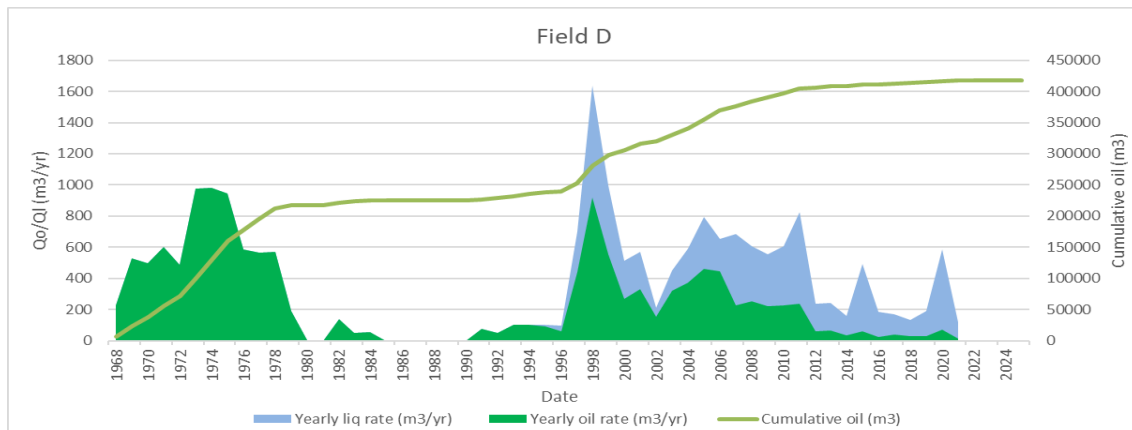
D-100:



Interpretations:

1. The well started producing in November 2000 with an initial oil flow rate of 11.62 m³/d
2. The maximum flow rate through this well was 27.91 m³/d
3. The well is producing water from the beginning
4. The well produced for 1 year then stopped for 1.5 years and again produced for 5 months then closed for 6 years till September 2009
5. The water cut reached 100 % in September 2014
6. The well was stopped producing in March 2017
7. Total production from the well was 11025.18 m³

Sand Analysis:



Interpretations:

1. The production from sand started in 1968 with flow rate of 225 m³/yr without water
2. The maximum production rate was 982 m³/yr in 1974
3. In 1985 the sand stopped producing due to pressure decline
4. Pressure declined from 364.09 in 1968 to 127.24 kg/cm² in 1983
5. Water injection was started in 1984 at an injection rate of 517.87 m³/yr
6. Injection was carried out for 4 years till 1988 then stopped for 2 years and again started
7. The maximum injection rate was 2766.39 m³/yr in 1998
8. After 2 more years the production started again in 1991 without water
9. In 1995 water production started
10. Oil production first increased till 1998 and then started decreasing
11. Pressure increased to 283.69 kg/cm² in 2007
12. Water cut started increasing reaching to 90 % in 2021 may be due to water breakthrough
13. Total injection into the field was 1805964 m³
14. Total oil production from the well was 417208 m³
15. During the initial years the production was good because the sand was in depletion drive as the pressure in the reservoir was depleting