

MBAL Software by Petroleum Experts

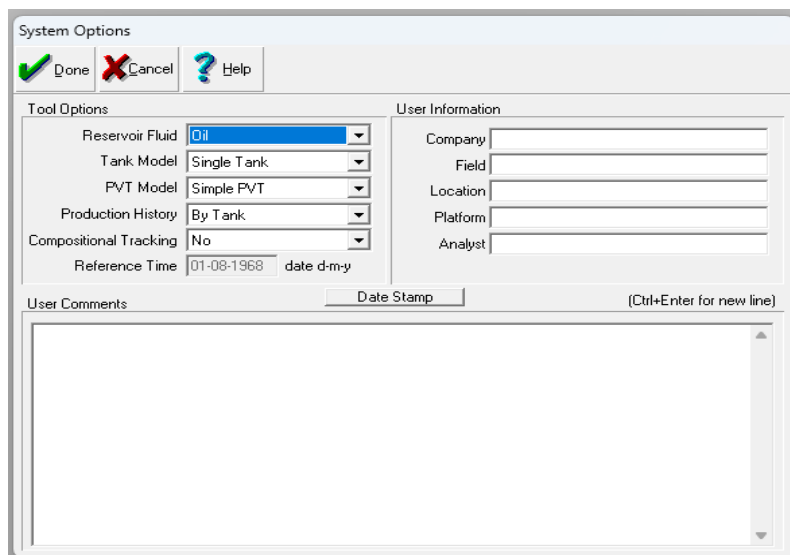
MBAL Program developed by **Petroleum Experts** works on the principle of material balance to estimate original oil in place (OOIP) by matching historical pressure and production data. It is used to understand reservoir behaviour, identify dominant drive mechanisms, and support field development planning.

Assumptions:

1. *Single-Tank System*: The reservoir behaves as a single tank with uniform pressure at any time with no spatial pressure gradients.
2. *Homogeneous and Isotropic Reservoir*: The reservoir has uniform properties (porosity, permeability, fluid saturation) throughout and behaves similarly in all directions.

Procedure:

1. Create a new file by clicking on *File* → *New*
2. Select the tool by clicking on *Tool* → *Material Balance*
3. Select options from the *Options* tab



The screenshot shows the 'System Options' dialog box in the MBAL software. It has a title bar 'System Options' and three buttons: 'Done' (green checkmark), 'Cancel' (red X), and 'Help' (question mark). The dialog is divided into two main sections: 'Tool Options' and 'User Information'.
Tool Options:
- Reservoir Fluid: Oil (selected in a dropdown)
- Tank Model: Single Tank (selected in a dropdown)
- PVT Model: Simple PVT (selected in a dropdown)
- Production History: By Tank (selected in a dropdown)
- Compositional Tracking: No (selected in a dropdown)
- Reference Time: 01-08-1968 (date d-m-y)
User Information:
- Company: (empty text field)
- Field: (empty text field)
- Location: (empty text field)
- Platform: (empty text field)
- Analyst: (empty text field)
At the bottom, there is a 'User Comments' section with a large text area, a 'Date Stamp' button, and a note '(Ctrl+Enter for new line)'.

4. Open Fluid Properties section by clicking *PVT* → *Fluid Properties*
 - Enter the following given values

Oil - Black Oil: Data Input

☒ Done
 ☒ Cancel
 ☒ Help
 ☒ Match
 ☒ Table
 ☒ Import
 ☒ Export
 ☒ Calc
 ☒ Match Param.

Input Parameters

Formation GOR: scf/STB
 Oil gravity: API
 Gas gravity: sp grav
 Water salinity: ppm
 Mole percent H₂S: percent
 Mole percent CO₂: percent
 Mole percent N₂: percent

Separator

Single-Stage

Correlations

Pb, Rs, Bo: Standing

Oil Viscosity: Beal et al

☐ Controlled Miscibility
☐ Use Tables
☒ Use Matching

- Click on *Match* and then entered the given values
Click on 'Match' again and then on 'Calc'

Oil - Black Oil: Matching

☒ Done
 ☒ Cancel
 ☒ Help
 ☒ Match
 ☒ Reset
 ☒ Import
 ☒ Plot

Temperature: degrees F
 Bubble Point: psig

| | Pressure psig | Gas Oil Ratio scf/STB | Oil FVF RB/STB | Oil Viscosity cp | Gas FVF ft ³ /scf | Gas Viscosity cp |
|----|------------------|-----------------------------|----------------------|------------------------|------------------------------------|------------------------|
| 1 | 2773.49 | 500.821 | 1.325 | 0.45 | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | |
| 7 | | | | | | |
| 8 | | | | | | |
| 9 | | | | | | |
| 10 | | | | | | |
| 11 | | | | | | |
| 12 | | | | | | |
| 13 | | | | | | |

- Click on 'Calc' and enter values
Then again click on 'Calc'

Oil - Automatic Calculation

☒ Done
 ☒ Cancel
 ☒ Help
 ☒ Calc

Data Points

☒ Automatic
☐ User Selected

PVT

Correlations

Pb, Rs, Bo: Standing

Oil Viscosity: Beal et al

Values

Temperature: degrees F
 Pressure: psig

From:
 To:
 # Steps:

1500
 5500
 100

- A tick must appear on 'Use Matching' indicating completion of process

5. Enter tank data by clicking *Input* → *Tank Data*

- Input 'Tank Parameters' as given
Then click on validate and next

Tank Input Data - Tank Parameters

Done Cancel Help Import

Tank Parameters Water Influx Rock Compress. Pore Volume vs Depth Relative Permeability Production History

Tank Type: Oil

Name: Tank01

Temperature: 237.2 degrees F

Initial Pressure: 5155.84 psig

Porosity: 0.2 fraction

Connate Water Saturation: 0.35 fraction

Water Compressibility: Use Corr 1/psi

Initial Gas Cap: 0

Original Oil In Place: 4.79874 MMSTB

Start of Production: 01-08-1968 date d-m-y

Monitor Contacts
Has Dry Gas Producers
Use Total Saturations
Gas Coning

<< Prior Next >> Validate

- In 'Water influx' do not select any model and then click on next
- In 'Rock Compressibility' select 'From Correlations'
- In 'Relative Permeability' enter the values
Then click on 'Calc' and then 'Validate'

Tank Input Data - Relative Permeabilities

Done Cancel Help Plot Copy Calc

Tank Parameters Water Influx Rock Compress. Pore Volume vs Depth Relative Permeability Production History

Rel Perm. from: Corey Functions

Modified: No

Water Sweep Eff. 100 percent

Gas Sweep Eff. 100 percent

| | Residual Saturation | End Point | Exponent |
|-----------------|---------------------|-----------|----------|
| | fraction | fraction | |
| K _{rw} | 0.3 | 0.5 | 2 |
| K _{ro} | 0.25 | 0.8 | 2 |
| K _{rg} | 0.02 | 0.9 | 2 |

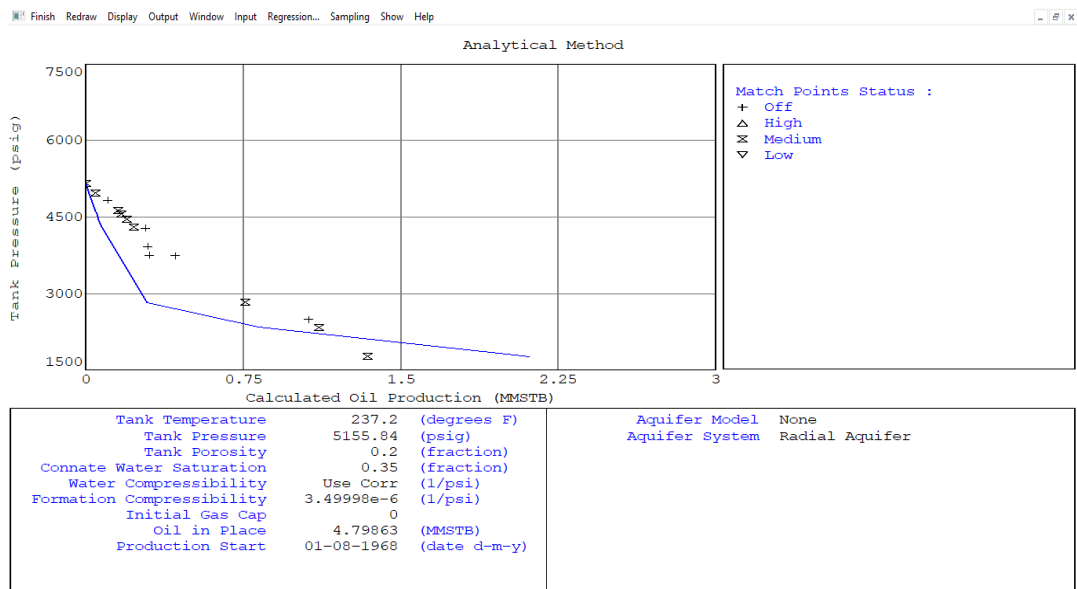
<< Prior Next >>

- In 'Production History' and add the data

6. Now go to *History Matching* → *Analytical Method*

A graph between Tank pressure (psig) vs Calculated oil production (MMSTB) will appear

- To adjust the scale of graph, click on *Display* → *Scale*
- Turn OFF the suitable points
- Go to 'Regression' and select 'Oil in place' to change the value of 'Initial Oil in Place'



Conclusion:

The analytical method plot displays the decline in tank pressure with cumulative oil production, indicating reservoir depletion over time. The pressure drops from approximately 5155 psig to below 2000 psig reflects a strong depletion trend without significant external support, consistent with the absence of an initial gas cap and no active aquifer model selected.

The estimated original oil in place (OOIP) is 4.79863 MMSTB, and the production began on 01-08-1968. The production data shows that the reservoir has been producing under depletion drive with limited pressure support, likely resulting in reduced recovery efficiency. These results suggest the need to evaluate pressure maintenance or enhanced oil recovery strategies to improve recovery moving forward.