Interference Test Analysis at Menengai Phase I Geothermal Field, Kenya.
Knowledge is gained by sharing, not by keeping it.
Objectives

• To determine the degree of reservoir continuity.

• To estimate transmissivity (T) and storativity (S)

• To determine the permeability thickness (kh)
Geothermal Prospects

- Barrier
- Namarunu
- Emuruangogolak
- Silali
- Paka
- Korosi
- Lake Baringo
- Lake Bogoria
- Arus
- **Menengai**
- Eburru
- Olkaria Complex
- Longonot
- Suswa
- Lake Magadi
Fault Structures
Interference Test Wells

**Observation Wells**
- MW-01
- MW-01A
- MW-09A
- MW-10A

**Production Well**
- MW-09B
- MW-17
- MW-17A
- MW-20
- MW-21A
Interference Test

1. Observation well
2. Production well

- Master valve
- Electrical housing
- Water level
- Distance (r)
- Pressure Chamber
- RESERVOIR

Separator
Weir box
Methodology

\[ \Delta p = \frac{q}{4\pi T} \int_0^{\infty} \frac{\exp(-u)}{u} du = -\frac{q}{4\pi T} Ei(-u) \]

\[ u = \frac{r^2 S}{4 T t} \]

\[ S = \phi c h \]

\[ T = \frac{k h}{\mu} \]

S: Storativity (m/Pa)

T: Transmissivity (m³/Pa·s)

\[ \Delta p_{obs}(t) = \Delta p_1(r_1, t) + \Delta p_2(r_2, t) + \cdots + \Delta p_n(r_n, t) \]
Observation Wells Data

MW-10A

MW-01A

MW-10A

MW-01A
Production Wells Data
Expected Results

- To get a good match between measured & calculated pressure changes.
- Get good estimates of Transmissivity & Storativity.
# Simulation Scenario

<table>
<thead>
<tr>
<th>MW-10A</th>
<th>Distance (m)</th>
<th>Case 1</th>
<th>Case 2</th>
<th>Case 3</th>
<th>Case 4</th>
<th>Case 5</th>
<th>Case 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW-09B</td>
<td>478.4</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>MW-17</td>
<td>1318.6</td>
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<td>1</td>
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<td>MW-17A</td>
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<td>1</td>
<td>1</td>
<td>1</td>
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<td>MW-20</td>
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<tr>
<td>MW-21A</td>
<td>905.7</td>
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<td>0</td>
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<tr>
<td>Transmissivity (m3/Pa·s)</td>
<td>7.182E-13</td>
<td>6.64E-13</td>
<td>1.45E-10</td>
<td>2.6E-10</td>
<td>3.38E-10</td>
<td>1.97E-10</td>
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<tr>
<td>Storativity (m/Pa)</td>
<td>7.638E-10</td>
<td>7.144E-10</td>
<td>3.51E-09</td>
<td>1.04E-08</td>
<td>1.27E-08</td>
<td>7.73E-09</td>
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<tr>
<td>Residual Sum of Squares</td>
<td>6927.0</td>
<td>6940.1</td>
<td>9072.1</td>
<td>8153.8</td>
<td>8046.2</td>
<td>8132.8</td>
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</tbody>
</table>
Interference Test Results.
MW-01 Results

Production Wells
MW-17 (580 m)
MW-20 (396 m)

\[ T = 1.57 \times 10^{-9} \text{m}^3/\text{Pa s} \]

\[ S = 1.94 \times 10^{-7} \text{m/Pa} \]
MW-10A Results

T = 3.43 x 10^{-10} m^3/Pa s
S = 1.27 x 10^{-8} m/Pa

Production Wells
MW-17 (1319 m)
MW-17A (979 m)
MW-09A Results

Production Well
MW-09B (344 m)
Conclusion

- Reservoir continuity is shown from results of MW-01 & MW-10A.
- Dual porosity geothermal reservoir is confirmed.
- Hydrologic connection exists between MW-10A, MW-17 & MW-17A.
- Possible impermeable boundary exists between MW-09A & MW-09B, needs further investigation from geology.
Recommendations

• Observation well monitoring should start one month before discharging wells.

• Set up a long term pressure monitoring for reservoir pressure.

• Employ use of TOUGH2 to analyze interference data.

• Regular checks on equipment for any pressure leakage or faulty electrical system.


Thank you