Application of Gas Gun in Improving Well Productivity/Injectivity in South Oman Area, a Field Case Study

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Outline

• Background
• Challenges
• What is the Gas Gun?
• The Gas Gun Compared to Hydraulic Fracturing and High Explosive
• Outcome
• Conclusion
BACKGROUND

• Mature Field in Southern part of Oman

• Different reservoir characters between fault blocks

• Declining reservoir pressure

• Water flood chosen as the IOR solution
CHALLENGES

• To complete the injection patterns within period of 10 months
• Long perforation intervals
• To manage the project expenditures
• To find the beyond current common perforations techniques
• Has to have ability to create an extra stimulations effect by improve well injectivity index
WHAT IS GAS GUN?

• The gas gun is not a simple propellant, it is the new generation (progressive burning propellant)

• A stimulation treatment - utilizes a solid- propellant explosive

• Multiple fractures radiating 10 to 50 feet from the wellbore

• Normally run on Wireline, contains a solid propellant
COMPARISON

- High explosives, detonate and create a shock wave. Pressures created are extremely high but last only a few microseconds.

- The solid propellant used in the Gas Gun does not actually detonate; it deflagrates.

- Gas pressures in the range of 20,000 psi are produced that last approximately 10 milliseconds.
OUTCOME

- Injectivity test after the conversion works
- Depend of the results, candidates then to be selected
- Had completed five jobs. Four for water flood wells & one producer well – all in sandstone formations.
- An incremental of 100% in term of injectivity rate (compared to the injection rate prior to the application).
- It was 50% incremental gain, with the shorter period compared to injectors.

<table>
<thead>
<tr>
<th>Well</th>
<th>Observation (before)</th>
<th>After</th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>Running hrs - 14</td>
<td>24 hrs (50% Incremental)</td>
</tr>
<tr>
<td>B</td>
<td>Inj. Rate : 40 m3/d</td>
<td>100 m3/d (2.5 times better)</td>
</tr>
<tr>
<td>C</td>
<td>Inj. Rate : 144 m3/d</td>
<td>216 m3/m (50% Incremental)</td>
</tr>
<tr>
<td>D</td>
<td>Inj. Rate : 100 m3/d</td>
<td>Inj. Rate : 200 m3/d (2 times)</td>
</tr>
<tr>
<td>E</td>
<td>Exp. Rate : 600 m3/d</td>
<td>Max rate : above 1000 m3/d</td>
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DISCUSSION

• The advantages over hydraulic fracturing:
  ❖ minimal vertical growth of fractures.
  ❖ multiple fractures are created, the entire zone is stimulated, there is no need to inject fluids.
  ❖ less equipment is needed, and the cost is much lower.
• Pressures created are between 10-20 thousand psi over 10’s of milliseconds *(theoretically, required proven data)*
CONCLUSION

• The treatment can’t always replace hydraulic fracturing.
• Large hydraulic fracture treatments can create a fracture hundreds, if not thousands of feet in length.
• But many small pay zones in marginal wells cannot justify the expense of these treatments.
• This approach can be a very economical alternative and requires much less equipment for the job executions.
• There are many applications where the Gas Gun can be used in place of hydraulic fracturing or in combination with hydraulic fracturing to achieve the desired outcome.
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