Sand Production and Its Control in Oil and Gas Wells: A Case Study of Egypt Nile Delta Oilfields

By

Professor Dr. A. A. Elgibaly*, Professor Dr. S. Kamel* and A. S. Elhawary**

Abstract

Oil industry Operators have to grapple with the challenges posed by sand, particularly in unconsolidated formations during the production process. If not properly managed, sand and fines can result in damage to surface/downhole equipment (which can lead to a major well intervention), flow line or vessels with the attendant environmental implications, not to mention huge sand disposal costs.

This paper is based on a study and evaluation of sand production and its control with particular emphasis on production activities in Egypt Nile Delta oilfields. The aim is to come up with a complete control system for protecting sub-surface and surface equipment by mechanical or chemical means while adjusting operating parameters to fit site situations. The essence in the main, is to identify the source of sand migration and follow its course to the nearest station for a local intervention (evaluation) before it culminates into a major damage to equipment and the environment in the subsequent stations.

The study follows through a complete control system from the pay zone to the last point in the plant process and the proposed solutions will further deepen the knowledge of combating the menace of sand intrusion in oil production process. It also institutes comparisons between well performance in different wells scattered over the entire area with or without on site control equipment with the ultimate aim of minimizing damage.

1. INTRODUCTION

Sand grain migration starts from the migration formation, well bore, production tubing, completion accessories, x-mas tree, choke, flowline, plant manifold and finally process equipment. (Fig1). The idea/goal is to stop the grain at the deepest station before it wreaks havoc on any station it passes through.

The Nile Delta oil fields provide a template for a proper case study of sand production and the proposed solutions and this is made more plausible due to their different stratigraphic columns, natural pay zones, rock reservoirs and well nature.

* Professor of Petroleum Engineering in Faculty of Petroleum and Mining Engineering, Suez University, Egypt
** Petroleum Engineering Section Head in Mansoura and Petroclitic Petroleum Company, Egypt.(+201222626437),(ahmedelhawary13@yahoo.com).
Co-existence with limitation depend on well type onshore/offshore, oil/gas, rates, water rate, and sand production rate.

Figure 1: Schematic shows the complete system solutions
2. STUDY OBJECTIVES

1. Problem Analysis
2. Sand production effects on the formation, perforation, casing, completion accessories, production tubing, choke, flow line, and processing equipments,
3. Complete solution system (surface/ sub-surface) and (mechanical / chemical),
4. Case study of Several Wells in Different Areas Represent the Nile Delta Oilfields of Egypt,
5. Calculation of maximum gas rate to avoid water coning and compare between it and the actual rates to know the reason of water coning and tubing erosion,
6. Conclusion and recommendations.

*Skin Factor (fine migrations made positive skin)*:

The value of the skin factor gives information about the damage that occurs to the formation due to fine migrations which made bores and perforations. Sand fill in the well bores leads to positive skin and reduction in the flow rate. Skin factor can be easily determined by drawing the difference in buildup pressure and the buildup time on a semi log plot. After determining the slope m, the skin factor can be determined by the following equation:

\[
s = 1.151 \left[ \frac{P_{1hr} - P_{wf at \Delta t=0}}{|m|} - \log \left( \frac{k}{\phi \mu C_f r_w^2} \right) + 3.23 \right]
\]

Where:

- \( s \): the skin factor
- \( P_{1hr} \): the pressure value after 1 hour of buildup (Psi)
- \( P_{wf at \Delta t=0} \): the Bottom hole flowing pressure at shut down (Psi)
- \(|m|\) : the slope

Sand can plug or erode all equipment in its way, such as casing, completion accessories, production tubing, choke, flow line, and processing equipments, as showed in Pics 1 to 8 below. The sand erosion and plugging effect on the choke body, bean, production tube, flow line, and valves, leads to not only production loss but also a dangerous situation of equipment fatigue. Also, sand erosion, plugging, and accumulation effect on the separator,

---

1 Adapted from extended abstract prepared in conjunction with oral presentation at GEO-2014, 11th Middle East Geosciences Conference and Exhibition, 10-12 March2014, GEO-2014@20141Geology Department, Faculty of Education, Suez Canal University, Arish, Egypt2Geology Department, Faculty of Science, Helwan University, Cairo, Egypt3Geology Department, Faculty of Science, Suez Canal University, Ismailia, Egypt.

filter, fittings, and control-check valves also leads to production loss due to equipment failure.³

* The prevalence of sand poses a significant production problem in several wells in different areas of Egypt's Nile Delta. What are the reasons adduced to early sand production (in well completion method and type, incorrect actions during the operation)? When does sand production start to appear, (in the case of water production, weak layer, unconsolidated sand, pressure sudden change, high drawdown or/and reservoir depletion). Table (1) highlights the position of three wells in the Nile Delta.

<table>
<thead>
<tr>
<th>Well Name</th>
<th>Area Name</th>
<th>Formation Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>K-4 and K-4st</td>
<td>Kafr El-shaikh</td>
<td>Abu-Madi , (10,000 ft)</td>
</tr>
<tr>
<td>S.Z-1, S.Z-1st</td>
<td>El-Mansoura</td>
<td>Qawasim , (8,500 ft)</td>
</tr>
<tr>
<td>W-1</td>
<td>Damietta</td>
<td>Qawasim , (8,500)</td>
</tr>
</tbody>
</table>

Table 1: Several Wells in Different Areas Represent the Egypt Nile Delta.

³ Mansoura petroleum company, East Nile Delta wells site photos
1. Wells K-4 and Well K-4st,\(^4\) as shown below, indicates that well k-4 gas production rate and well head pressure decrease with time while water and sand production increase. As sand erode the production tubing, a lot of pin holes were discovered, then the workover operation was carried out to replace the eroded production tubing of the well. For some time the well condition did not change, hence the decision was taken to side track the well to be k-4st completed with open hole gravel pack. This measure gave a good result of water and sand production and it became the first example of a successful sand control mechanical system.

2. Wells S.Z-1 and S.Z-1 st\(^5\), (are shown below below). S.z-1 produces gas at high pressure accompanied by medium water and sand production. In effect, the well was shut-in due to high facilities erosion (i.e. choke body, bean, and flow line). The right decision was taken to side track the well to be s.z-1 st completed with cased hole gravel pack. As widely recognized, water production is a good carrier for sand but in spite of increase in water production, the sand production is low when compared with the data of s.z-1, a successful example as sand control mechanical system is thereby recorded.

3. Well W-1\(^6\) (shown below) indicated another technique without workover recompletion operations by consolidating the formation sand and preventing it from migration. This action resulted in a successful field application of a chemical-based sand control system predicated on Aqueous-Based Formation Consolidation Treatment.

Well K-4 History\(^7\)

Well K-4 was drilled vertically (Spud-in on Nov 8, 2006) to Qawasim formation (TD @ 10400' RKB). The open hole logs and mud logs showed that Abu Madi formation is a hydrocarbon bearing zone. In the offset well K-2 ST the MDT showed that the reservoir pressure of Abu Madi is 4697.2 psi @ 9980 ft S.S. The open hole logs and mud logs showed that Abu Madi formation is a hydrocarbon bearing zone. The USIT & VDL-CBL Logs showed bad cement bond. Therefore, cement squeezing jobs were conducted through the perforation (10000-10004) 4ft RKB.

- Consequently, the decision was made to test and complete the well on Abu Madi intervals (9968 - 9976) 8 ft, and (9986 - 10000) 14 ft using Halliburton 4 5/8" TCP (12 SPF, HMX, 30° phasing, 0.38" hole entrance and 32" penetration with STIM) On Oct 1\(^{st}\), 2007 an RST job was performed for this well as a base run


\(^5\) Masoura petroleum company
\(^6\) Mansoura petroleum company
\(^7\) SPE-SAS-358 , Successful Field Application of Aqueous-Based Formation Consolidation Treatment Implemented in Nile Delta, Egypt, Sumit Songire, Amro Hassan, and Mohamed Amer, Halliburton; Saber Farid, Jean-Marie Luijlx, and Mohamed AbdelKhaleq, WASTANI Petroleum, This paper was prepared for presentation at the SPE-SAS Annual Technical Symposium & Exhibition held in Al Khobar, Saudi Arabia, April 21-24, 2014,
• On Oct 16, 2008, the choke size was increased from (32/64") to (34/64"), with increasing in sales gas rate from 16.1 to 17.3 MMSCFD, and water rate from 18 to 20 BBLD with the same rate of condensate (28 STBD).

• On Oct 18, 2008 a dummy run was made for this well, and the top of gun was tagged at 10136' T.H.F.

• On Nov 4, 2008 a second RST job was performed for the well to identify the reservoir contact.

• On Dec 8, 2008, the choke size was increased from (34/64") to (36/64"), with increasing in sales gas rate from 16.9 to 18.8 MMSCFD, water rate from 20 to 23 BBLD, and condensate rate from 28 to 29 STBD.

• On Mar 15, 2009, the choke size was increased from (36/64") to (38/64"), with increasing in sales gas rate from 17.7 to 19.5 MMSCFD, water rate from 22 to 24 BBLD, and condensate rate from 27 to 30 STBD.

• On July 14, 2009, the perforating interval 10000' - 10020' (20 ft) was added using 2 1/8" power spiral through tubing gun, to increase the production rate from the well and to eliminate the partial penetration observed in it.

• On 20, July, 2009, the choke size was increased from (38/64") to (40/64"), with increasing in sales gas rate from 18.4 to 19.6 MMSCFD and condensate rate from 24 to 27 STBD, with the same production rate of water (23 BBLD).

• On Nov 24, 2009 a slick line job was performed for this well to set memory gauges.

• On June 15, 2010, the choke size was increased from (40/64") to (42/64"), with increasing in sales gas rate from 17.5 to 18 MMSCFD, water rate from 20 to 23 BBLD, and condensate rate from 21 to 24 STBD.

• In Sep, 2010, the well showed higher water salinity than normal as salinity increased from +/-700 upto +/-17,800 Cl- ppm for ten days, while the casing head pressure increased from +/-390 psi to +/-1850 psi. The big communication port in this well has led to a casing head pressure of 650 psi while the well is continuously bled to the atmosphere. All efforts to bring this casing head pressure to zero while venting to atmosphere were unsuccessful.

Some practical tests were conducted in the field to define where the gas entry to the annulus emanated. It can be concluded that the gas entry to the annulus occurred from a source below the SSSV and not from Tubing Hanger.

Therefore, a work over program is needed for this well.

• On June 09, 2011, the well was closed to work over program (removing the production tubing and running a new one and installing new tie in packer) to solve the casing pressure issue.

---

8 Well location khafer elshekh, Nile Delta, Egypt
• On July 04, 2011, the well was opened on choke size (42/64’’), with average feed gas rate +/- 11.5 MMSCFD, average condensate rate 12 STBD, and average water rate 100 BBLD (WHP=1740 Psig).

• On Jan 17, 2012, the well chock size was decreased from (42/64”) to (40/64”) and, well head pressure increased from 1370 to 1435 Pissg.

• On March 21, 2012, choke beaning was decreased from (40/64”) to (36/64”)

• On May 30, 2012, the well choke beaning was replaced due to choke erosion consequently WHP was increased from 1340 Psig tp 1365 Psig. Water production was increased from 226 BBLD to 274 BBLD.

• On June 11, 2012, the choke beaning was replaced due to sand erosion, The WHP increased from 1330 psig to 1360 psig.

• On July 11, 2012, choke adaptor had been replaced due to sand erosion, its WHP increased from 1315 to 1380 psig.

• On January 4, 2013, Sapesco desander was installed in the well. The cumulative sand production during a 15 day period from desander is 16.4 Kg, and 12.6 Kg from sand catcher (installed on the well).

• On May 24, 2013, WHFP was decreased till it reached FLP, therefore the well was switched to flare pit to be unloaded without success. In effect, it was closed due to buildup pressure till it got to 1300 PSIG On June 10, 2013.

• On June 11, 2013, the well was opened and switched to flare to be unloaded without success. Thereafter, it was closed due to build-up pressure.

• On November 16, 2013, well K#4 killing job was performed to side track the well.

• On November 16, 2013, the rig was accepted and the well was P&A on Nov 29, 2013. The well was Side tracked to well K-4ST.

Abu Madi Formation Petrophysical data:

• Gross Pay = 110 ft

• Net Pay = 98 ft

• Average Porosity Ø = 30 %

• Average Water Saturation Sw = 25 %
Well K-4ST History

Well K-4ST was drilled as a side track well from the watered out well W.Khilala-4 "Spud in Nov 16, 2013.

Well K-4 ST was drilled from 5889 ft MD RKB (KOP) with maximum deviation 36.55 degree to (TD @ 10645' MD RKB). The open hole logs and mud logs showed that Abu Madi formation is a hydrocarbon bearing zone.

Consequently, the decision was made to complete the well using open hole gravel pack to Abu Madi formation. The open hole section was (10606-10645) 39 ft.

- On Jan 10, 2014 the well was put initially on production.
- The rig was released on Jan 12, 2014.

Production History:

- On Jan 20, 2014, Well K-4 ST was opened on K gas plant on choke (20/64)" and the FWHP-1365 with 3 MMSCF/D gas, 3 BBL/D condensate, and 17 BBL/D water.
- On Jan 26, 2014 The well was closed to run the memory gauges in hole. Thereafter, it was opened again on choke size (20/64)"and the well was tested on K gas plant separator.
- On Jan 30, 2014 the well was shut down for khelala manifold replacement and opened again on 1-Feb-2014.

Abu Madi Formation Petrophysical data:

- Gross Pay = 80 ft.MD./ 66 ft.TVT
- Net Pay = 62 ft. MD./ 51 ft. TVT
- Average Porosity Ø = 18%
- Average Water Saturation Sw = 34%
- Pressure Data (@ 9980 TVD S.S) = 1718 psi

---

9All data actual field survey, Mansoura Petroleum Company
*Well S.Z-1:*

- Reservoir pressure, Psia 3825
- Reservoir Temperature, °F 185
- Gas-Water Contact Depth, TVD SS 8442
- Drive Mechanism Strong Bottom Water Drive
- Geological age/Forma\(\text{tion}\) Miocene/Abu Madi
  Lithology: Sandstone
- Average Porosity, % 25
- Average Water Saturation, %
- Gross Pay thickness, ft. 97.5
- Net Pay thickness, ft. 62.
- Fluid Type Rich Gas Condensate
- Gas Gravity 0.683
- Condensate Gravity, API 53°
- Condensate-Gas Ratio, bbl/MMscf 38

Figure 7: Wells K-4 and K-4st (together) Gas, Water, Sand, and cond. Rate Vs Time
Well W-1:\n
Successful Field Application of Aqueous-Based Formation Consolidation Treatment Implemented in Nile Delta, Egypt:

![Completion sketch](attachment:completion.sketch.png)

**Figure-2: Well W-1 Completion sketch**

<table>
<thead>
<tr>
<th>Phases</th>
<th>Concentration (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illite/smectite (mix)</td>
<td>08</td>
</tr>
<tr>
<td>Halite</td>
<td>04</td>
</tr>
<tr>
<td>Na-feldspar</td>
<td>08</td>
</tr>
<tr>
<td>K-feldspar</td>
<td>04</td>
</tr>
<tr>
<td>Calcite</td>
<td>03</td>
</tr>
<tr>
<td>Anhydrite</td>
<td>01</td>
</tr>
<tr>
<td>Quartz</td>
<td>72</td>
</tr>
</tbody>
</table>

**Table-2: Well W-1 Core Sample X-ray diffraction (XRD)**

10. Well location Khafer Elshekh, Nile Delta, Egypt
11. SPE-SAS-358, Successful Field Application of Aqueous-Based Formation Consolidation Treatment Implemented in Nile Delta, Egypt, Sumit Songire, Amro Hassan, and Mohamed Amer, Halliburton; Saber Farid, Jean-Marie Luijkx, and Mohamed AbdelKhaleq, WASTANI Petroleum, This paper was prepared for presentation at the SPE-SAS Annual Technical Symposium & Exhibition held in Al Khobar, Saudi Arabia, April 21-24, 2014.
12. SPE-SAS-358, Successful Field Application of Aqueous-Based Formation Consolidation Treatment Implemented in Nile Delta, Egypt, Sumit Songire, Amro Hassan, and Mohamed Amer, Halliburton; Saber Farid, Jean-Marie Luijkx, and Mohamed AbdelKhaleq, WASTANI Petroleum, This paper was prepared for presentation at the SPE-SAS Annual Technical Symposium & Exhibition held in Al Khobar, Saudi Arabia, April 21-24, 2014.
Figure 3: Well W-1 sand production before and after Aqueous Base Resin

Figure 4: Well W-1 production rate before and after Aqueous Base Resin

13 SPE-SAS-358, Successful Field Application of Aqueous-Based Formation Consolidation Treatment Implemented in Nile Delta, Egypt, Sumit Songire, Amro Hassan, and Mohamed Amer, Halliburton; Saber Farid, Jean-Marie Luijkx, and Mohamed AbdelKhaleq, WASTANI Petroleum, This paper was prepared for presentation at the SPE-SAS Annual Technical Symposium & Exhibition held in Al Khobar, Saudi Arabia, April 21-24, 2014.
Figure 5: Well W-1 production rate before and after Aqueous Base Resin

*Gas Injection is also a good formation supporting agent to maintain the reservoir pressure. This consequently increases the grain bond with reservoir depletion and reduce fine migration.

Below is an actual field example (in an oil reservoir located in the East Nile delta) that illustrates the gas injection mechanism as an effective sand control method. The well started production in Dec 2007. Re-injection of produced gas was initiated in March 2010. Even though a lot of pinholes were recorded before re-injection took place, almost all pinholes disappeared after re-injection and pigging.

---

14 SPE-SAS-358, Successful Field Application of Aqueous-Based Formation Consolidation Treatment Implemented in Nile Delta, Egypt, Sumit Songire, Amro Hassan, and Mohamed Amer, Halliburton; Saber Farid, Jean-Marie Luijcx, and Mohamed AbdelKhaleq, WASTANI Petroleum. This paper was prepared for presentation at the SPE-SAS Annual Technical Symposium & Exhibition held in Al Khobar, Saudi Arabia, April 21-24, 2014.
Reservoir Pressure
Before & After
Re-Injection of The Produced Gas
In Oil Reservoir located in East Delta

*Start Production in Dec 2007,
*Start Re-Injection of the Produced gas In Mar 2010,
*Before Gas Re-injection a lot of Pin holes,
*After Gas Re-injection and pigging System the pin hole almost disappear.

*Calculation of maximum gas rate to avoid water coning:

\[
q_{g(max)} = \frac{0.000703 \ kg \ h \ (p_e^2 - p_w^2)*[( b/h)*(1+7\sqrt{(r_w/2b)} \ Cos(\pi b/2h))]}{z \ T \ \mu g \ ln(re/ r_w)}
\]

Where:

- \( q_g \) : max gas flow rate (Msc/d)
- \( kg \) : effective gas permeability (md)
- \( h \) : gas zone thickness (ft)
- \( Pe \) : reservoir pressure at drainage radius (psia)
- \( pw \) : wellbore pressure at drainage radius (psia)
- \( b \) : footage perforated (ft)
- \( Rw \) : wellbore radius (ft)
Petroleum Technology Development Journal (ISSN 1595-9104): An International Journal; January 2016 - Vol. 6 No. 1

- **Z**: gas compressibility factor
- **Tr**: reservoir temperature (°R)
- **μg**: gas viscosity at reservoir conditions (cp)
- **re**: external drainage radius (ft)

*Calculated wells data summary:

Several Wells in Different Areas Represent the Nile Delta Oilfields of Egypt.

<table>
<thead>
<tr>
<th>Well Name</th>
<th>Area Name</th>
<th>Formation Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>(6 wells Dry Gas)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S.Z-1 and S.Z-1st</td>
<td>El-Mansoura (Middle Delta)</td>
<td>Qawasim (8,500 ft)</td>
</tr>
<tr>
<td>(2 wells Gas Condensate)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Well Name</td>
<td>Location</td>
<td>Formation</td>
</tr>
<tr>
<td>-----------</td>
<td>----------</td>
<td>-----------</td>
</tr>
<tr>
<td>K-1</td>
<td>Khafir</td>
<td>Abu-madi</td>
</tr>
<tr>
<td></td>
<td>Elsheikh</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Remark: *Bad liner cement* | Pri=4600 (in 2005) Pri=1600 (in 2015) *sand cleanout and wso

| K-2       | Khafir   | Abu-madi  | 10,000     | 7 (liner)       | 30"           | conventional   | 54               | 50          | 3500            | 19 WO (2011) | 25            | 0              | 17                          |
|           | Elsheikh|           |            |                 |               |                | 3500             | 1400         | 1900            | 3 WSO (2016) | 100           | 4              | 0                           |
|           |          |            |            |                 |               |                | 1600             | 1400         | 1900            | 3 WSO (2016) | 200           | 0              | 0                           |
|           |          |            |            |                 |               |                | 500              | 1400         | 1900            | 3 WSO (2016) | 500           | 0              | 0                           |
|           |          |            |            |                 |               |                | 0                | 1400         | 1900            | 3 WSO (2016) | 500           | 0              | 0                           |

Remark: *Bad liner cement* | install sand catcher before workover *Gun stuck perforation front

| K-4       | Khafir   | Abu-madi  | 10,000     | 7 (liner)       | 30"           | conventional   | 42               | 42          | 3500            | 20 WO (2011) | 100           | 0              | 16.5                         |
|           | Elsheikh|           |            |                 |               |                | 3500             | 1300         | 1900            | 20 WO (2011) | 120           | 2              | 0                           |
|           |          |            |            |                 |               |                | 1300             | 1200         | 1900            | 20 WO (2011) | 450           | 10             | 0                           |
|           |          |            |            |                 |               |                | 1300             | 450          | 1900            | 20 WO (2011) | 450           | 10             | 0                           |

Remark: Bad liner cement *can't wso its the main sand

| K-4st     | Khafir   | Abu-madi  | 10,000     | 6              | Open hole enlarged to 8.5 | Gravel pack 4" screen (12-20)mesh gravel | 28     | 1300  | 6    | 25   | 0    | 6.5 |
| 30° dev   | Elsheikh|           |            |                |                  |                                       | 28     | 1300  | 6    | 25   | 0    | 6.5 |
| Sw=94%    |          |            |            |                |                  |                                       | 28     | 1300  | 6    | 25   | 0    | 6.5 |
| (2014)    |          |            |            |                |                  |                                       | 28     | 1300  | 6    | 25   | 0    | 6.5 |

Remark: 45° open hole section

---

15 Table with all important wells data and calculated maximum gas rate that shouldn’t be exceeded to avoid water coning
<table>
<thead>
<tr>
<th>Well Name</th>
<th>Location</th>
<th>Formation</th>
<th>Depth (ft)</th>
<th>Casing size (in)</th>
<th>Perf. phasing</th>
<th>Completion type</th>
<th>Chk size (64&quot;)</th>
<th>WHP (psig)</th>
<th>Gas rate (MMscf/d)</th>
<th>Water rate (bbl/d)</th>
<th>Sand rate (kg/d)</th>
<th>Calculated Max. gas rate (MMscf/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>K-8 74° dev Sw=40% (2012)</td>
<td>Khafir Elshekh</td>
<td>Abu madi</td>
<td>10,000</td>
<td>5 (liner)</td>
<td>0-180° (210°)</td>
<td>conventional</td>
<td>40</td>
<td>36</td>
<td>1,200</td>
<td>10</td>
<td>1.5</td>
<td>5</td>
</tr>
<tr>
<td>Remark: *install desander *difficult intervention due to high angle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K-9 40° dev Sw=55% (2013)</td>
<td>Khafir Elshekh</td>
<td>Abu madi</td>
<td>10,000</td>
<td>8.5 (open hole)</td>
<td>Open hole</td>
<td>Open hole</td>
<td>Gravel pack 5.5&quot; screen (12-20) mesh gravel</td>
<td>38</td>
<td>32</td>
<td>1,050</td>
<td>5</td>
<td>1.5</td>
</tr>
<tr>
<td>Remark: <em>bad open hole section and bad cleaning during drilling and completion</em>PLT Showed that the bottom screen section is plugged (Jun 2013)*SPS Showed that the all screen section is plugged (Mar 2014)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-2-1 Vertical (2009)</td>
<td>Elmansoura</td>
<td>Qawasim</td>
<td>8500</td>
<td>7 (liner)</td>
<td>30°</td>
<td>conventional</td>
<td>44</td>
<td>14</td>
<td>2,300</td>
<td>20</td>
<td>5</td>
<td>150</td>
</tr>
<tr>
<td>Remark: *the well closed due to high pressure and gas rate with any sand will damage all sub-surface and surface facilities *Strong Bottom Water Drive</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*S-2-1 st 22° dev (2013)</td>
<td>Elmansoura</td>
<td>Qawasim</td>
<td>8500</td>
<td>5.5 (Expandable liner)</td>
<td>30°</td>
<td>Cased hole Gravel pack 3.5&quot; screen (12-20) mesh gravel</td>
<td>34</td>
<td>24</td>
<td>2,900</td>
<td>11</td>
<td>5</td>
<td>30</td>
</tr>
<tr>
<td>Remark: *gravel pack efficiency excellent</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

16 Table with all important wells data and calculated maximum gas rate that shouldn’t be exceeded to avoid water coning
3. Proposed Solutions:

1. Primary solution should commence from the first day of production, (adjusting the production parameters and sizing) is germane.

2. Rigless well intervention solution should take into account sand fill cleaning, water shutoff, resin chemical injection, surface sand catcher, De-sander, filter, flow line pigging, surface/subsurface chemical injection, surface monitoring system, internal processing vessels cleaning.

3. Rig intervention and workover operations should take cognisance of recompletion and sand control systems change or install, gravel pack

4. Rock and wellbore Stability could be conducted to study the core, payzone and reservoir properties and type which should give fillip to the technique to be used or employed.

4. CONCLUSION AND RECOMMENDATIONS:

1. Special Core Analysis and wellbore Stability Study not only helps in sand control but also recommend the optimum operating parameters, completion type,

2. Drill the well vertically Or 30 deg. deviation, Oriented/selective perforation, and completed with cased/open hole gravel pack,

3. Materials, equipments, and tools selection during the well drilling, completion, and production avoids a lot of problems,

4. Dealing with the well from the first moment of Production with good, right, and correct engineering way helps in avoid the occurrence of future problems,

5. Good choice for the initial intervention methods may solve the problem without rig.