Subsea Water Injection for IOR

DECC / INTSOK – UK / Norway
Cross – border business to business
Mentoring programme 2012 - 2013
Talisman UK – Seabox

Experience shared at
Scotland – Norway Network Meeting
iPark, Stavanger
18 February 2014
Pairing Compatibility

- Talisman Sinopec Energy operates a large portfolio of assets in the UK sector of the North Sea and have a lot of satellite fields that are tied back to existing platforms. This gives a relatively high platform to reservoir ratio – on average, each platform, or production area, serves 4 fields.

- This gives interesting opportunities in utilising the flexibility that subsea waterflooding gives in order to get away from some of the constraints inherent in waterflooding from a topsides facility point of view - i.e. a single facility that is supposed to feed more than one field.

- For brownfield duty, ageing assets could be a particular problem area for Talisman which will be reflected in corrosion and regularity problems - e.g. corroded subsea WI pipelines and topsides water treatment plants.

- For any potential greenfield duty, subsea waterflooding could perhaps open up the possibility for waterflooding without having to rely on ageing infrastructure
Claymore – Piper area is an example of an area with extensive infrastructure and mature assets, and where TLM has significant involvement, challenges and opportunities.

Source: http://www.talisman-energy.com/upload/media_element/61/03/061215__icop__claymore_
Summary of Activities Outside Arranged Meetings

- Meeting in Aberdeen with TLM UK, 27th June 2012
- Meeting in Aberdeen with TLM UK, 2nd October 2012
- Telephone conferences
- Emails
- Meeting follow ups
- Establishment of business opportunities

Interest to Seabox:-
- Gain an understand of Talismans current philosophies (for each production area)
- Understand if there is anything Talisman would like to do differently

Interest to Talisman:-
- Illustration of the benefits that SWIT and subsea waterflooding can give for both brown field and green field developments.
Technology Qualification

A number of operating companies are currently considering implementation, where SWIT is part of concept selection process. Some (majors) has completed their internal technology qualification procedures. These exercises include:

- Operability reviews
- Installation
- Constructability
- Monitoring equipment
- Effects on the reservoir
The SWIT Technology

1. Raw sea water enters the SWIT through a proprietary design electrochlorinator, that generates sodium hypochlorite. All water is passed through the cells.

2. A very large treatment volume (Still Room) ensures 1-2 hours residence time. This ‘chlorine soak’ ensures a very effective disinfection of the seawater (bacteria kill).

3. A very laminar flow regime is combined with common industry solids settling principals (tilted plates) to provide optimum conditions for particle sedimentation without use of filters.

4. Hydroxyl radicals are preferentially generated by electrolysis. This provides secondary kill for any surviving bacteria and enables mineralisation of neutral buoyancy organic material.
SWIT – ‘A Game Changer’

Traditional Topsides Water Injection

- Restriction in number of available well slots
- Restriction in drilling reach from the topside
- Difficulty in achieving optimal flood regime
- Restrictions in available weight & space

Seabed Water Injection

- No weight & space restrictions
- Reduced CAPEX & OPEX
- Flood flexibility - Improved sweep (via flexible inj. quantity & location)
- ‘Real time’ management of reservoir drainage strategies
Treatment Capabilities - SWIT + Membranes

- Low salinity / sulphate waterflooding
- Solids removal < 0.1 μ - Matrix flooding
- Normal waterflooding – SWIT

SWIT:
- Outstanding disinfection
- Mineralisation of organics
- Removal of 99% of particles > 24μ

Reverse osmosis  Hollow fiber MF  SWIT

Low salinity  Low sulphate  Matrix flooding  SWIT water
# SWIT Product Capability – Development Phases

4 phases successfully completed – 5th phase under development

<table>
<thead>
<tr>
<th>SOLUTION READY FOR MARKET</th>
<th>UNDER DEVELOPMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase I</td>
<td>Phase IV</td>
</tr>
<tr>
<td>Phase II</td>
<td>Phase V</td>
</tr>
<tr>
<td>Phase III</td>
<td></td>
</tr>
<tr>
<td>Full Scale Pilot Testing (2009 – 2011)</td>
<td></td>
</tr>
</tbody>
</table>

‘SWIT 40’ is fully tested, qualified and READY FOR MARKET

- Oil companies have used test results to complete their own technology readiness evaluations
- Next generation - SWIT + Membranes for Low Salinity and Low Sulphate water

✓ = Successfully Tested
Commercial – items of note

Commercial / Procurement / HSE discussion:

- Good understanding of Talisman systems, expectations and requirements.
- Differential between ‘sole source’ and ‘single source’
- Prequalification for a Direct tender explored
- HSE and management system have to be in place
- Seabox track record – ‘portfolio’ of tests/pilots is good

- Financial stability – parent company/ bank guarantee
- Adequate resources
- Different contractual set-ups, direct or with system integrator
- LOGIC (terms and conditions) – normally applied
- FPAL registration recommended
Examples of Synergies With Other Members of the Cross border INTSOK / DECC initiative

- Representative of TAQA facilitated meeting with some of his field development colleagues. TAQA has an interesting portfolio – challenging in many aspects with aging assets – but still with plenty reserves and upside to be chased.

- Representative of Petrofac arranged meeting with some of his field development colleagues in another division of Petrofac. Incentives schemes for Petrofac to produce more oil could pave the way for smarter ideas on secondary recovery.

- DECC – meetings held with DECC in London in relation to general IOR opportunities on the UKCS. Introduction to other schemes such as PILOT.
Have we met the objectives of the B2B initiative?

- Buy-in for progression of EOR projects and encourage investment in new technologies • Maybe
- Improved understanding of the UK / Norway markets • Yes
- Enhanced understanding of the way Oil Operators / Major Contractors work and think leading to improved business relationships • Yes
- SME business strategy improvements with significant benefit expected in the longer term • Yes
- Growth in export turnover and profitability • No
- Improved management systems / processes • Yes
- Improvements in Supply Chain interfaces and better understanding of contracting strategy • Yes
- Provided a very open and honest environment to discuss shared issues between Operators, Contractors and SME’s • Yes
- Significantly improved network of contacts • Yes
Conclusion

- The B2B cross border initiative established a ‘different and complementary’ arena – a very useful ‘investment’

- However, follow-up (meeting) is vital to secure momentum and long term gains