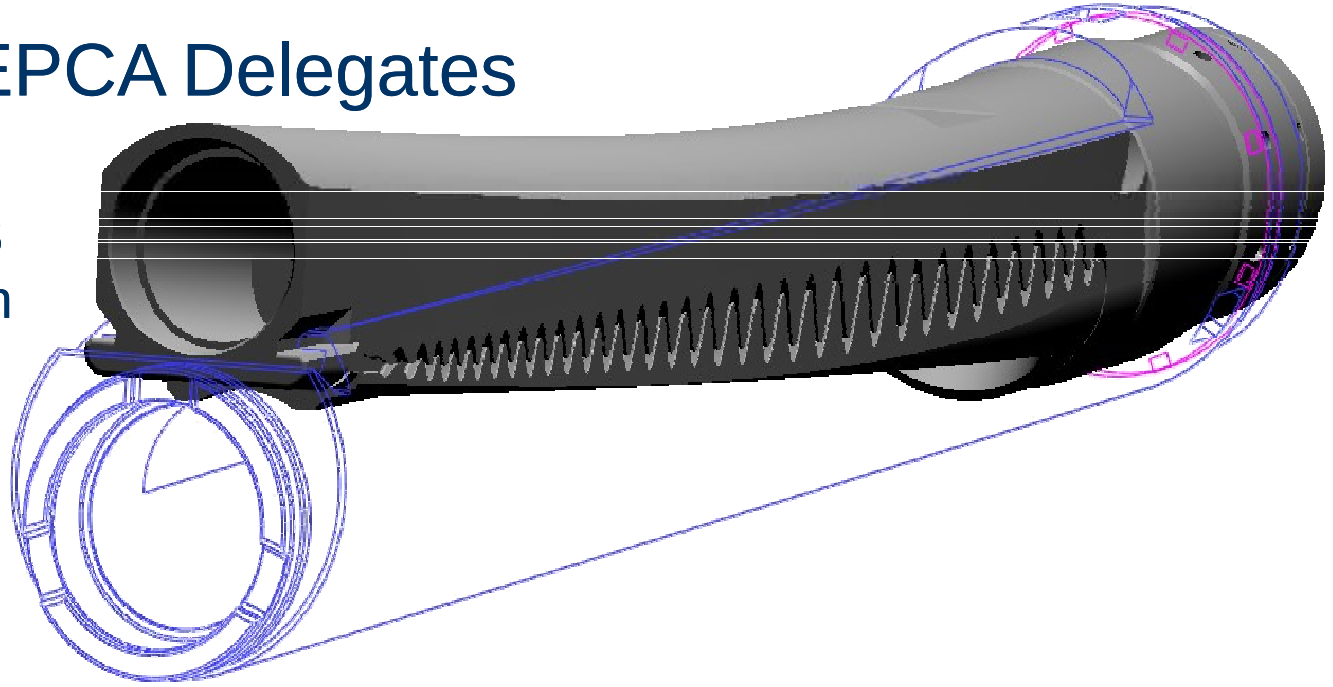
Multilateral Technology

Multilateral Solutions

Welcome PPEPCA Delegates

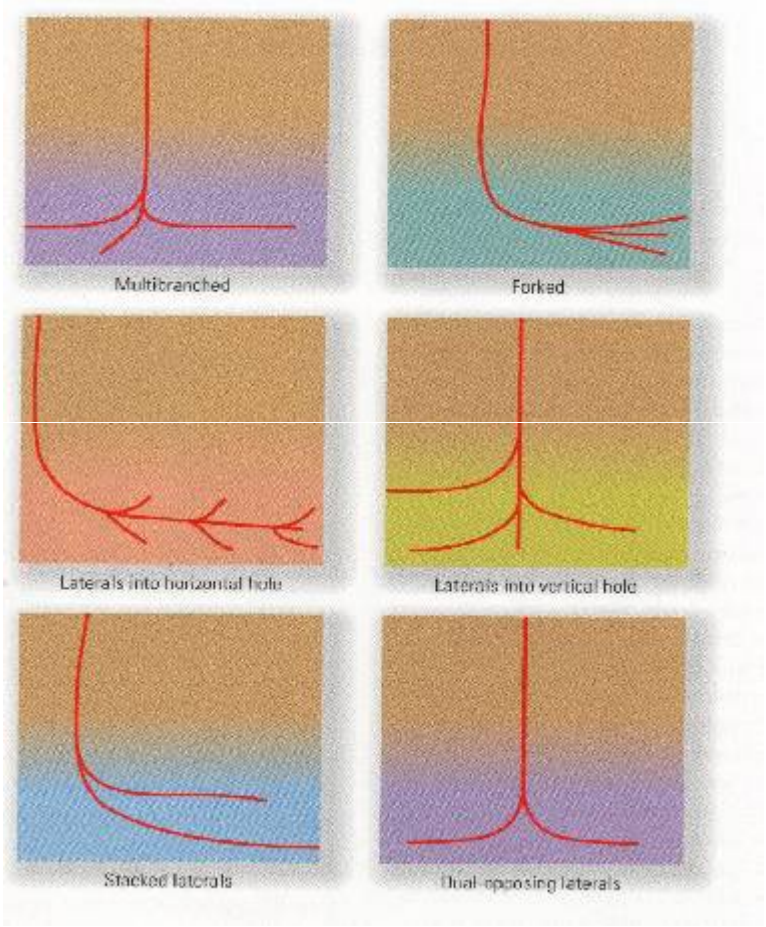
November 3rd, 2008
Islamabad, Pakistan

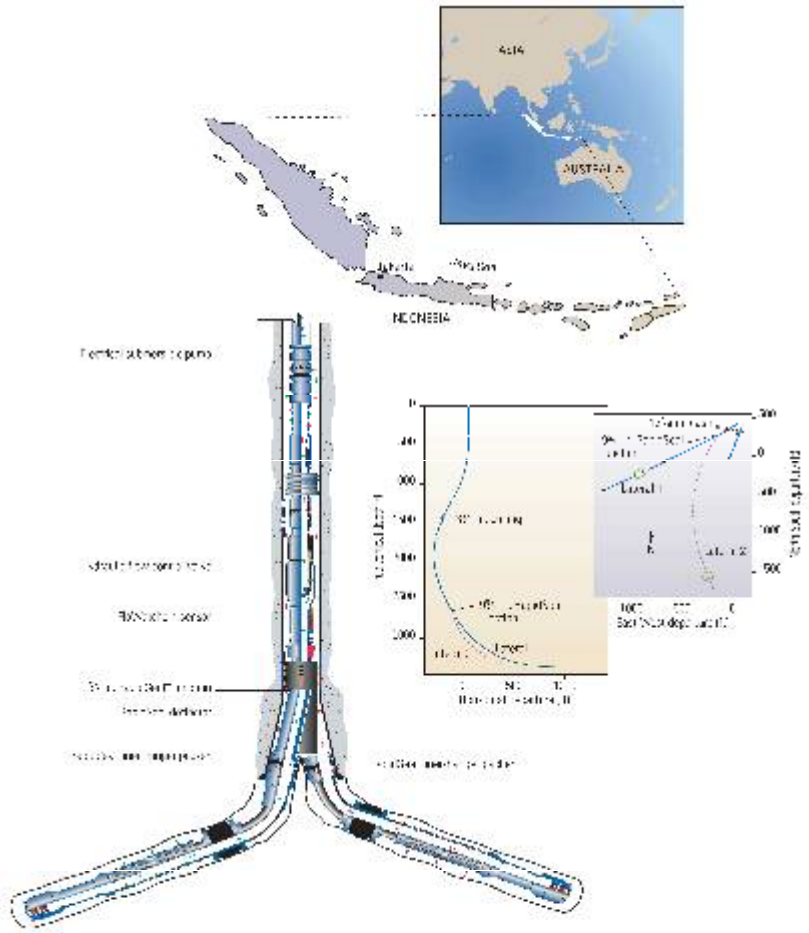


Tim O'Rourke - Multilateral Manager, Middle East and Asia

Arshad H. Palekar - Geology Domain Champion – Pakistan

What is a Multilateral Well and is this new and emerging technology ?





Multilateral Technology and some patents

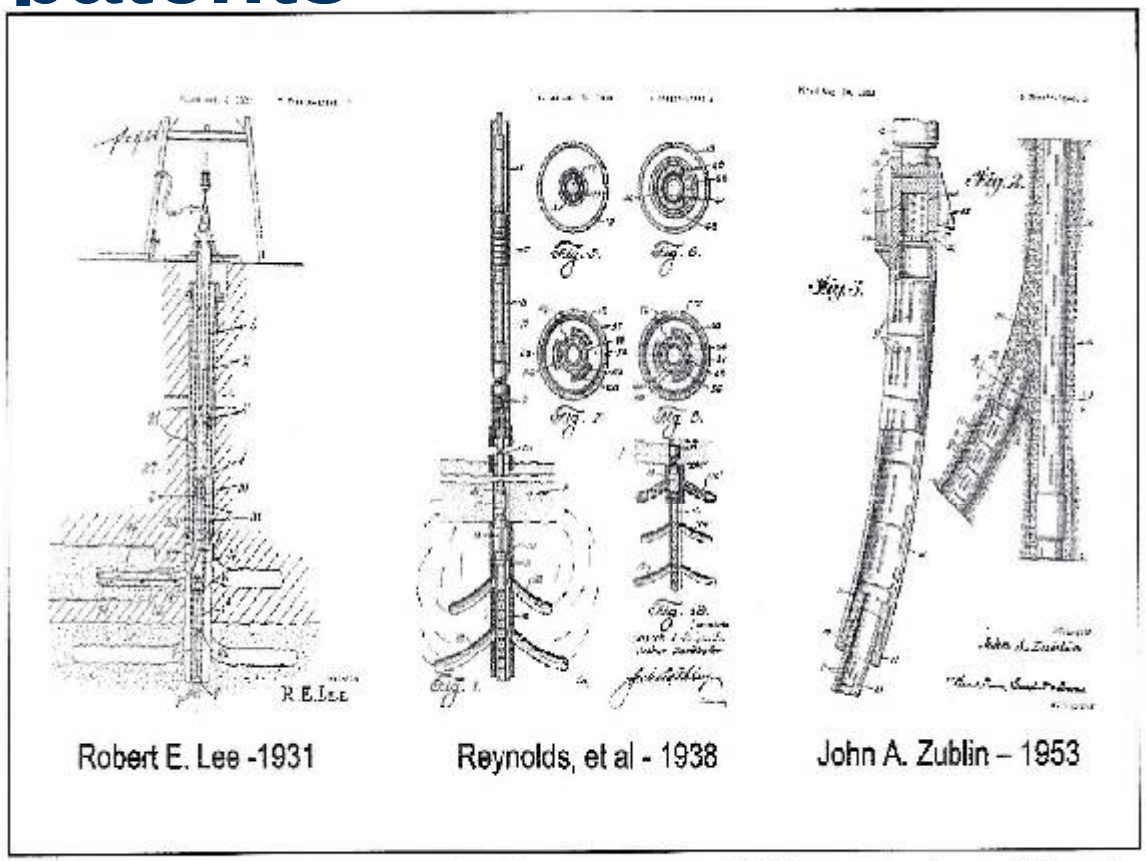
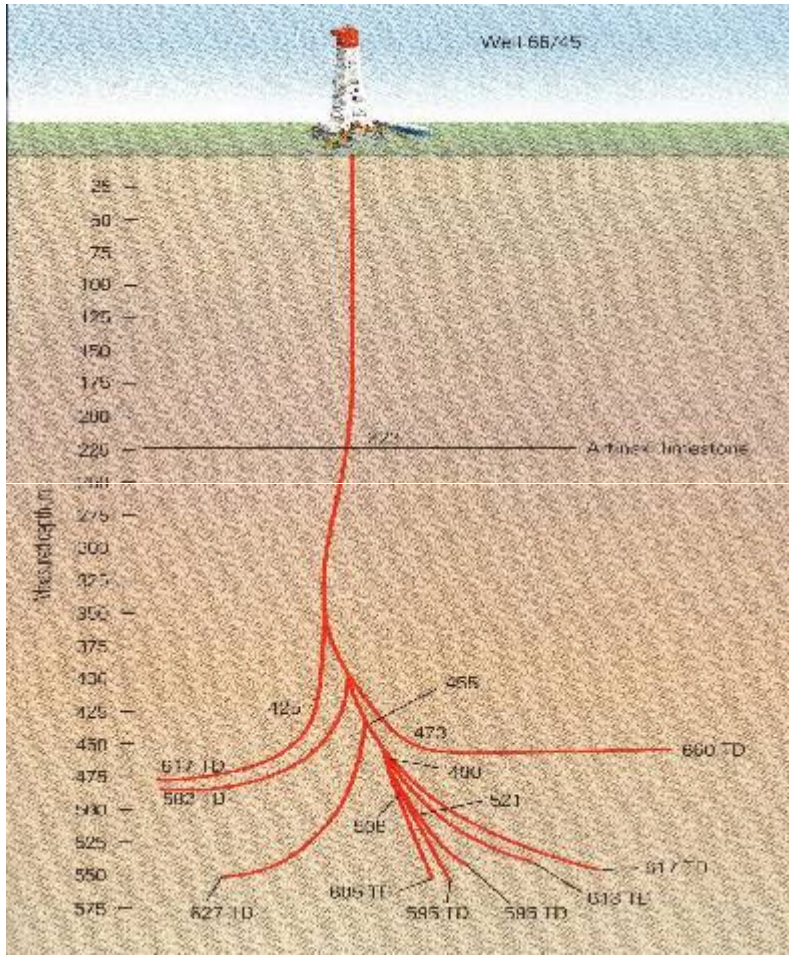


Figure 1. The first multilateral technology patent was filed in 1929 and was followed by additional patents. (Images courtesy of TAML)

- 1929 – Leo Ranney rudimentary attempts MLs. He drilled a 2.44 m vertical shaft in Ohio, put men and equipment in the bottom of the hole and they dug horizontal holes– he also drilled in a horizontal radial pattern, *"spokes of a wheel"* perhaps creating the 1st ML ever.
- In the 1940's John Zublin drilled horizontal drain holes for operators in Calif.
- In 1945 Mr. Zublin eventually re-enters 250 wells in Calif., West Texas and Wy. Averaging 2 laterals per well

Information courtesy Hart E&P Mag Aug 07 & Julie Bonner, Chairperson TAML

ML's are Not New



Information courtesy Hart E&P Mag Aug 07 & Julie Bonner, Chairperson TAML

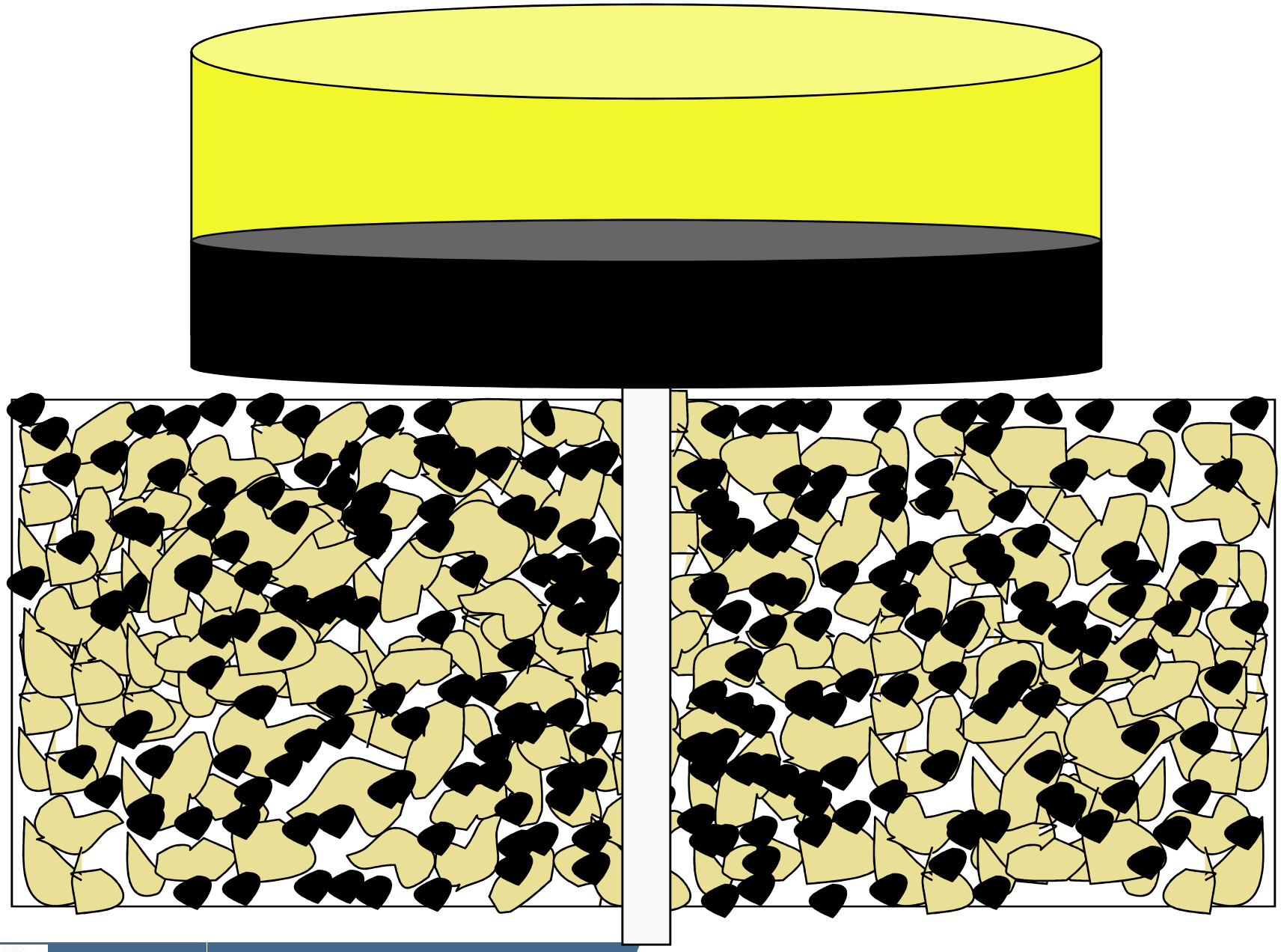
1939 – Alexander Grigoryan graduated from Azerbaijan Industrial Institute.

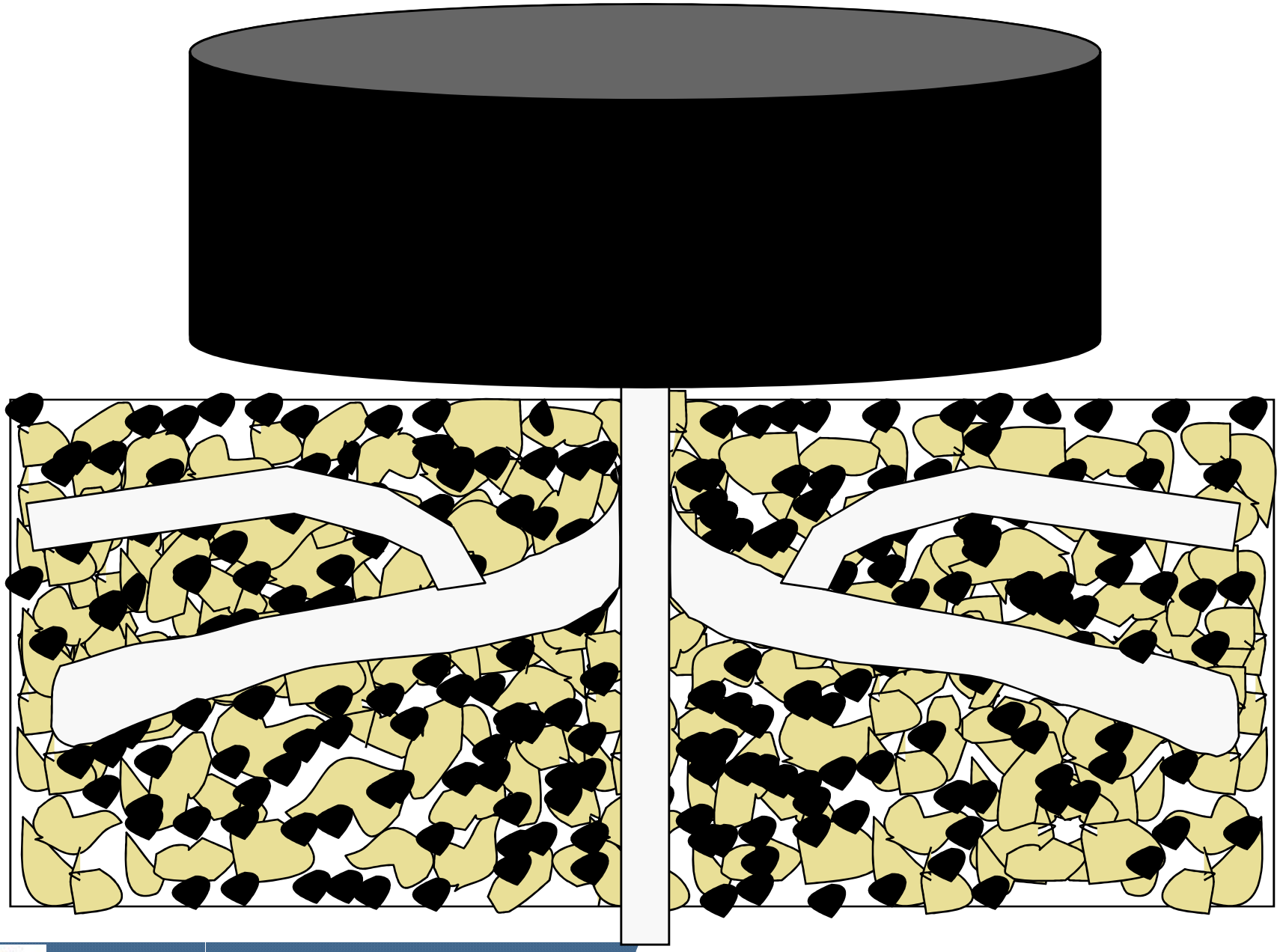
1941 – He drilled, what is on record, the world first directional well (Baku 135) using only Turbo Drills.

This directional well led to him to develop a way to increase of production in the same way a "*tree root extends to soil".*

* In 1953 he drilled (66/45) 9 branches, ea leg 80 to 300 m without whipstocks or cement plugs
* Increased exposure to the pay zone by 5.5 times
* Increased production by 17 times

110 wells followed from Eastern Siberia to the West Ukraine near the Black Sea.





WHO and What is TAML? (Technology Advancement of Multilaterals)

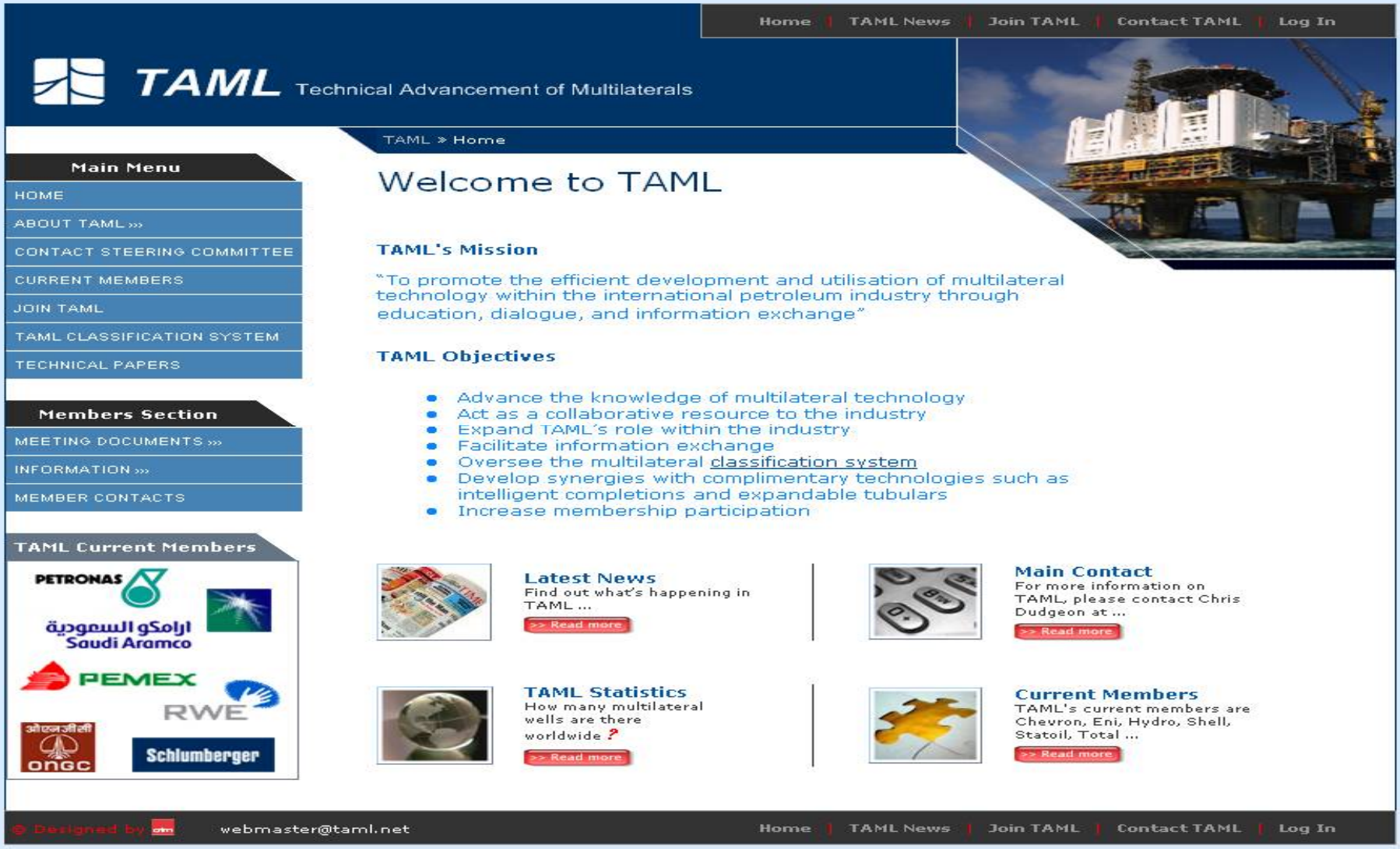
Convened in March of 1997 – Eric Diggen Shell

"To promote the efficient development and utilization of multilateral technology within the international petroleum industry through education, dialogue, and information exchange"

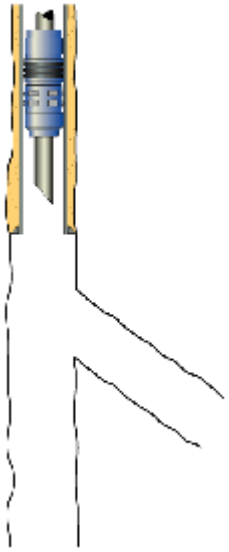
Today's Members –17 Operators, 8 Service Companies

BG, BHP, Chevron, ConocoPhillips, ENI, ExxonMobil, Maersk, Hydro, OMV, ONGC, Pemex, Petronas, RWE Dea, Saudi Aramco, Shell, Statoil, Total, APA, Baker Oil Tools, Blade Energy Partners, Halliburton, Schlumberger, Smith Services, The Expro Group, Weatherford

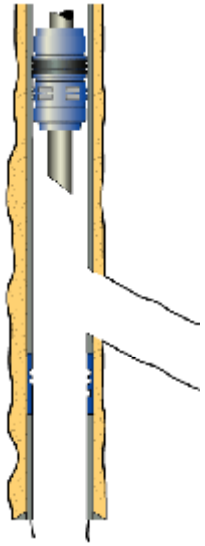
http://www.taml.net/



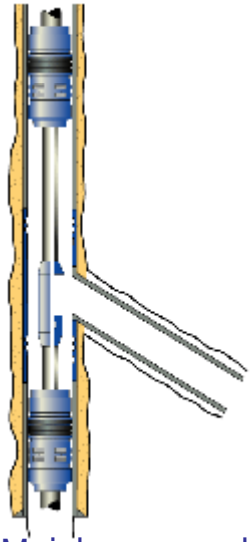
What are the TAML Classifications



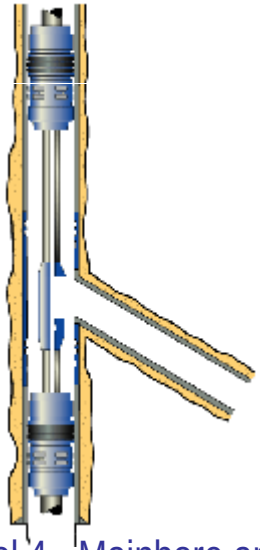
Level 1
Open hole mainbore
Open hole lateral



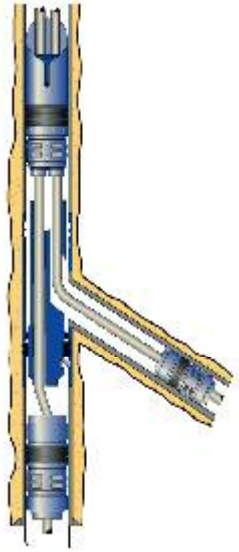
Level 2
Mainbore cased
Open hole lateral



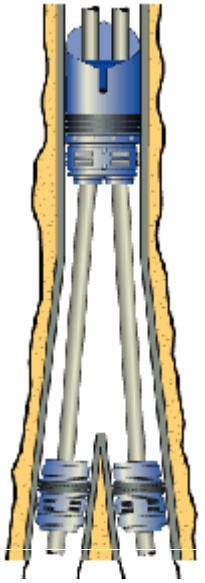
Level 3 - Mainbore cased
Mechanical support
in the lateral



Level 4 - Mainbore and
lateral cemented

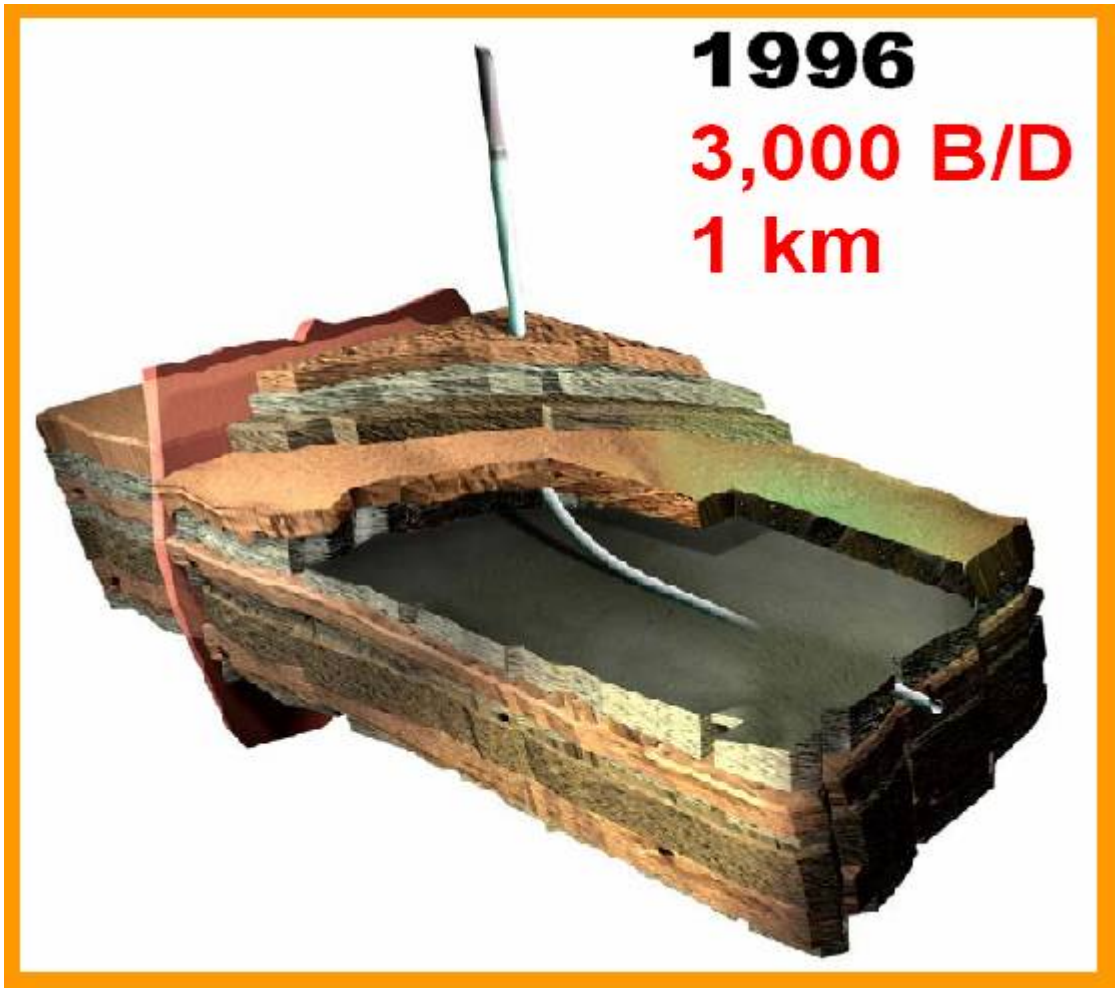


Level 5 - Hydraulic
isolation at the
junction



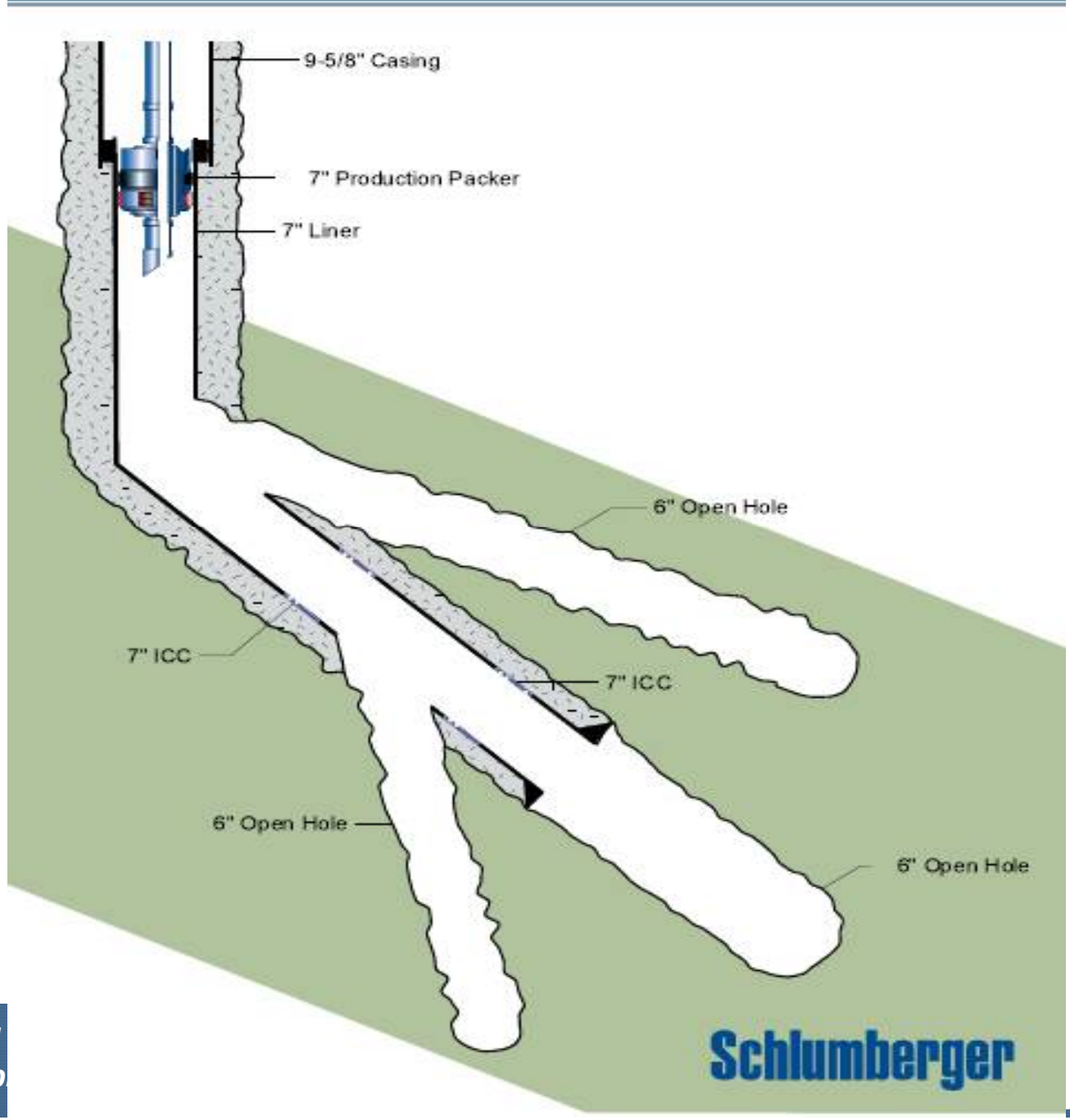
Level 6 - Pressure
integrity within the
junction

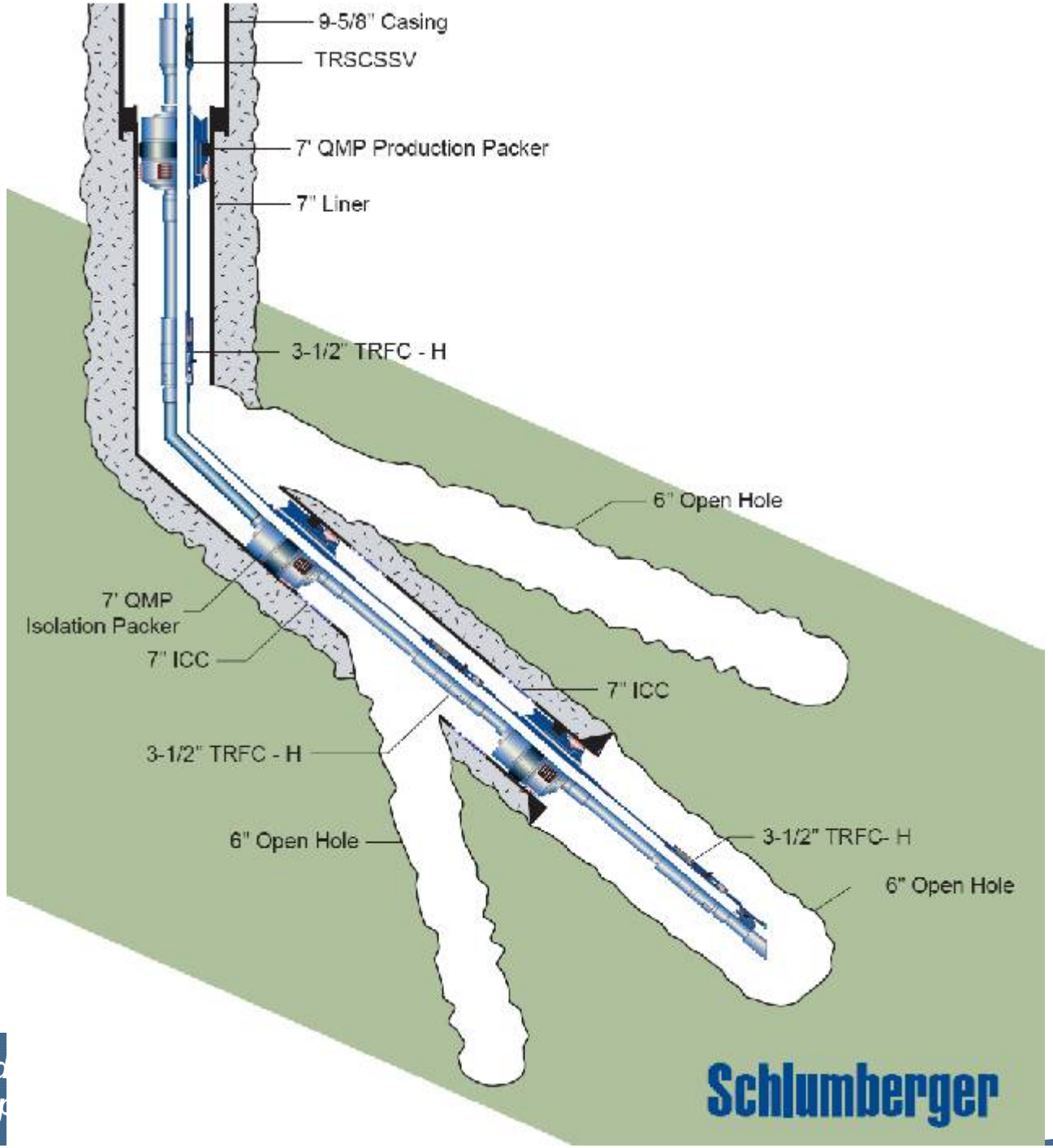
Saudi Aramco – Typical Well



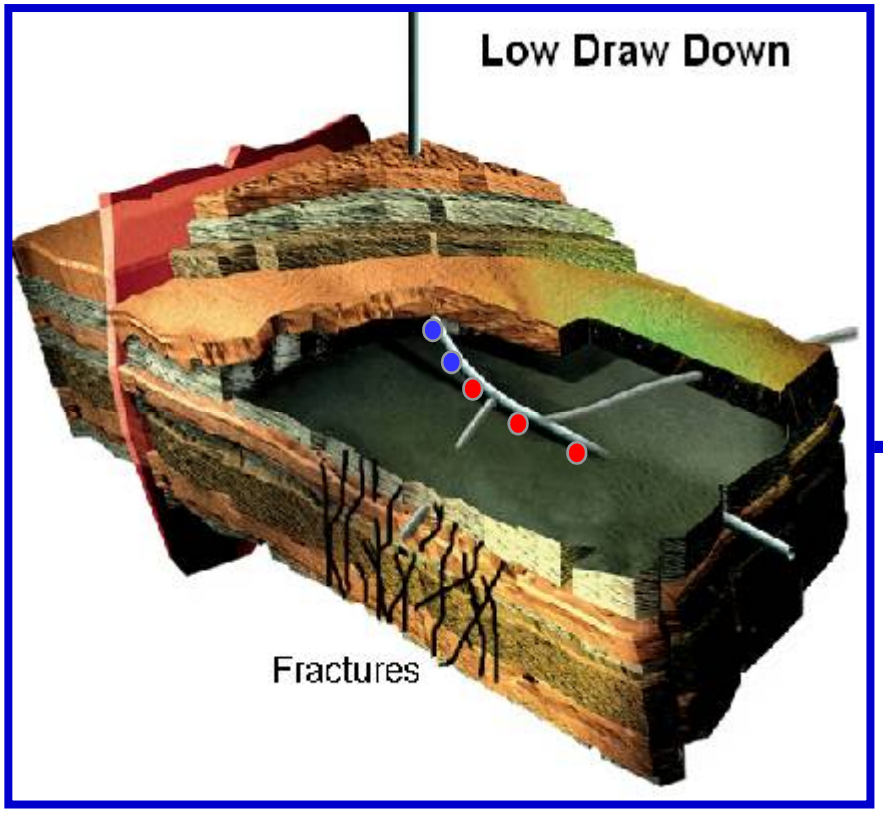
Saudi Aramco – Maximum Reservoir Contact (MRC's) up to 30K' of pay

Multilateral Well without Flow Control

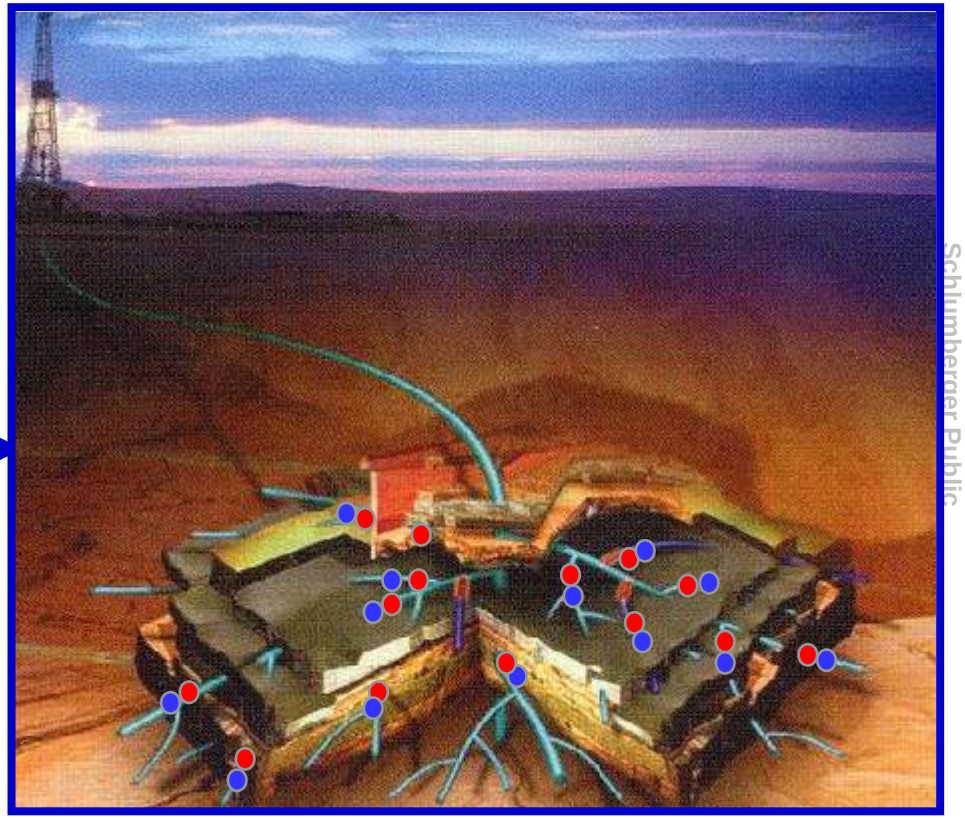




The Future MRC's to ERC's
"Extreme Reservoir Contact" 50K' to 75K' in the pay



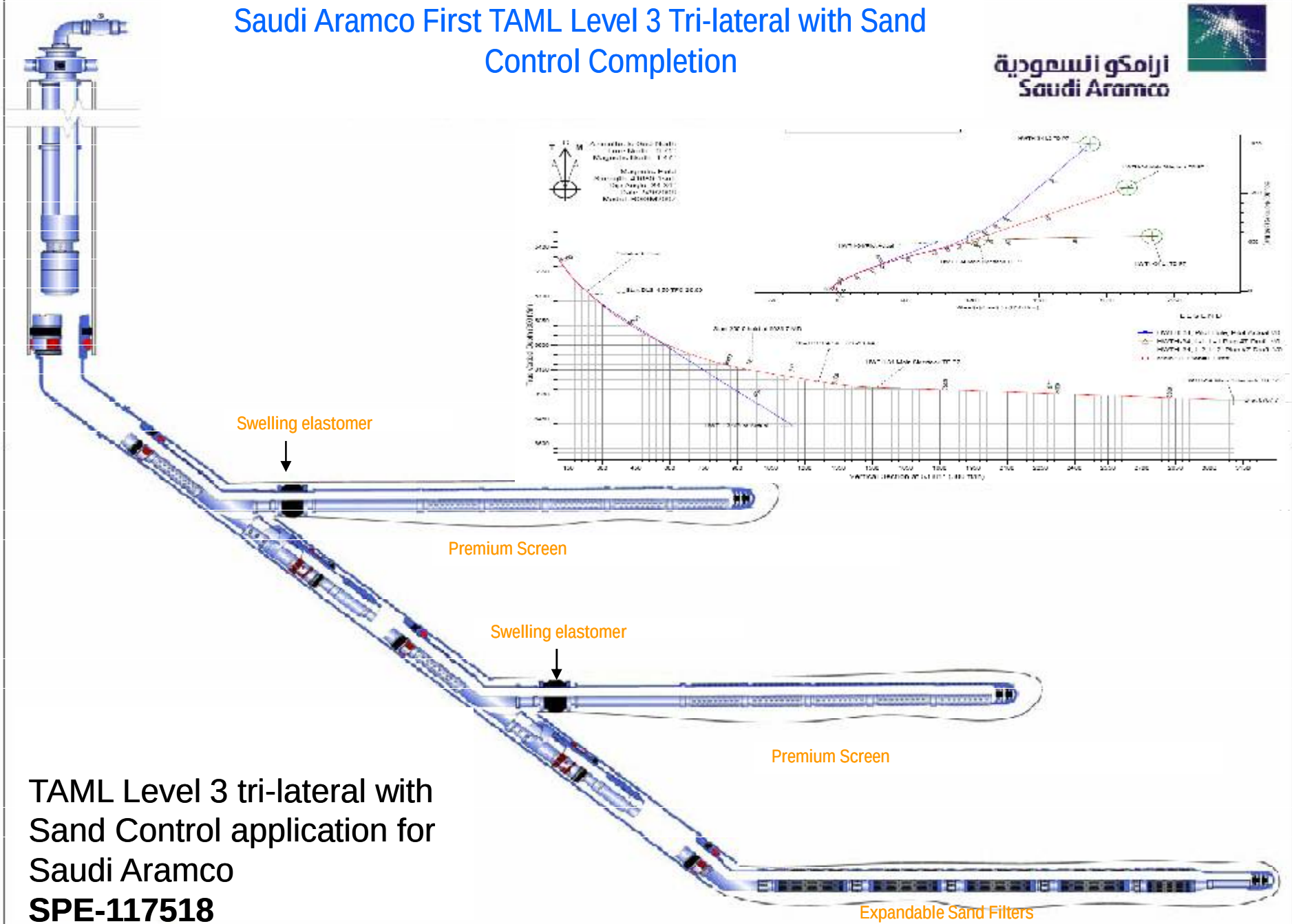
Current MRC (Maximum Reservoir Contact wells) Wells



Future ERC (Extreme Reservoir Contact) Wells

CASE STUDIES

Saudi Aramco First TAML Level 3 Tri-lateral with Sand Control Completion



TAML Level 3 tri-lateral with Sand Control application for Saudi Aramco

SPE-117518

Conclusions Impact and Cost Savings:

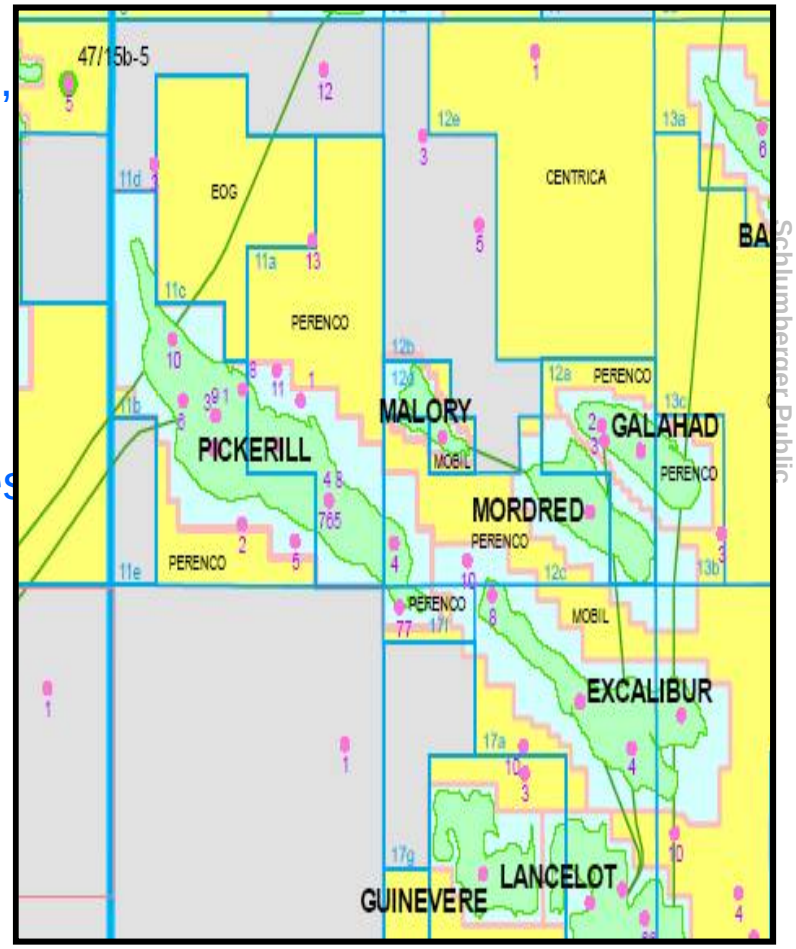
- Promising performance during the initial clean up (3500 BPD).
- Further clean up is ongoing to get the final production rate.
- Three (3) Single Re-Entries Vs. One (1) Tri-Lateral Re-Entry
  - Saving $ 1,5 MM and 70 days rig time.
  - ESP , Surface equipment
- Alterative Tri-Laterals System (Level- 4)
  - Saving $ 150,000 and 3 days rig time.
- Tri-Lateral Re-Entry in Central Arabia can achieve a significant saving in cost and rig time for the entire project.
- TAML Level 3 reduces operation risk involving Tri-Lateral Re-Entry.
- The second well of this pilot project is planned toward end of year before final decision of replacing single re-entries to multi-lateral re-entries in this field

Case Study (PICKERILL FIELD)

S. W. Bokhari et. al., SPE 38629

Location: UK Southern North Sea

- Discovered in 1966
- Produces from the Rotliegendes Formation, Leman Sandstone
- ARCO was the Operator in 1996
- GIIP 900 BCF
- Proven reserves 550 BCF
- Top 2 of the 6 zones were tight
- Substantial un-produced GIIP in top 2 zones
  - Avg Porosity: 12%
  - Avg. Permeability: 0.1- 0.5 md
  - Initial pressure: 3995 psi
  - Temperature: 204 deg F
  - Depth: 8900 ft TVDSS



Case Study (PICKERILL FIELD)

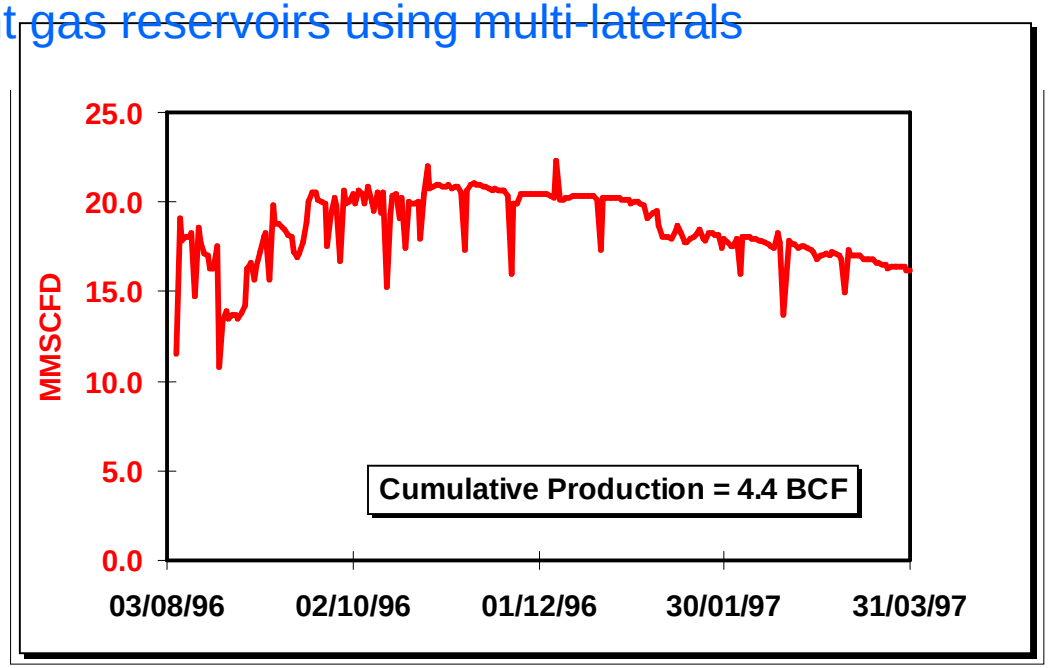
S. W. Bokhari et. al., SPE 38629

- A3 was suspended due to very low gas production rates (<1 mmscfd) and water handling concerns
- In 1996 (after 30 years production), BHP was taken in this well to determine if there was any depletion due to production from other wells within fields
- Results showed that the top two tight zones were at virgin pressure (deeper zones were below GWC at this location)
- Simulation model showed multilateral well could produce initially at 15 mmscfd and recover an additional 15 BCF of reserves
- In the Summer of 1996, ARCO drilled its first multi-lateral well in Southern North Sea at A3 as A3ZY

Case Study (PICKERILL FIELD)

S. W. Bokhari et. al., SPE 38629

- Dual laterals were successfully side tracked and produced with an average rate of 18 MMCFD – performed better than predicted (estimated recoveries of 25 BCF)
- A3ZY well had not produced any water till the time SPE paper was published
- This was the first applications of multilateral technology in the UKCS by ARCO and the knowledge gained from this work resulted in developing several additional tight gas reservoirs using multi-laterals



Conclusion & Recommendation

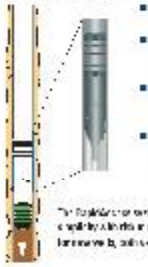
Following are the prerequisites for Horizontal & Multilateral wells :

- Recoverable reserve volume
- 3D seismic; top/bottom and extent of the producing layers
- Established Oil/Gas and water contact
- Incase of Carbonates:
  - Fracture network maps; orientation, distribution and density
- Incase of Clastic:
  - Reservoir Characterization; porous permeable layers and their productivity
- Geomechanical earth model:
  - Stress directions & quantification, rock strength analysis

RAPID Multilateral Technology

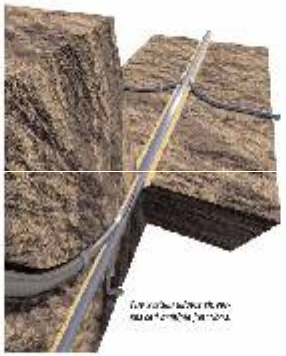
Schlumberger

RapidAccess

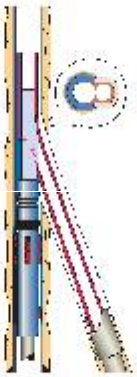


RapidTrip

RapidQuad



RapidConnect



RapidExclude

RapidX

Rapid ML System's
Simple Solutions

Schlumberger

Thank You!

Question