Unleashing potential of old SI wells during 2021
Area A Brown field, Gulf of Suez, Egypt

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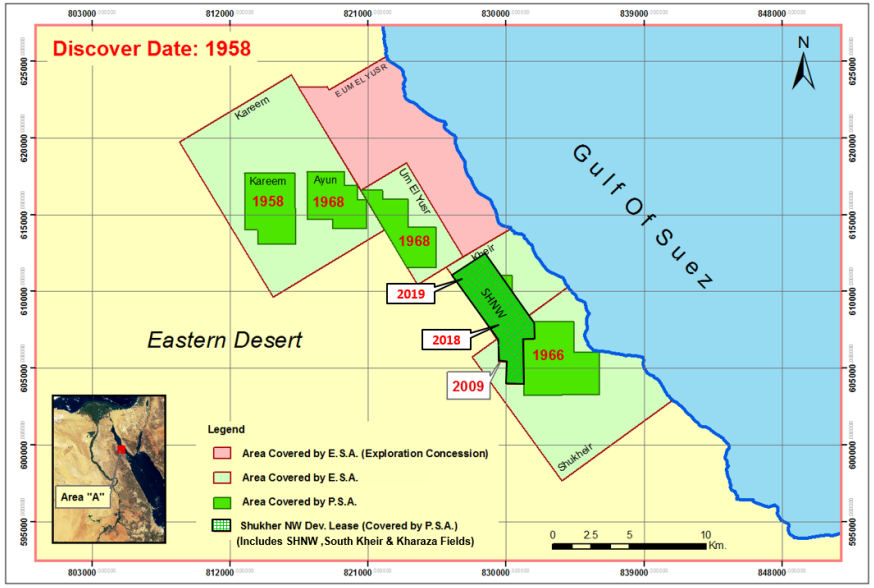
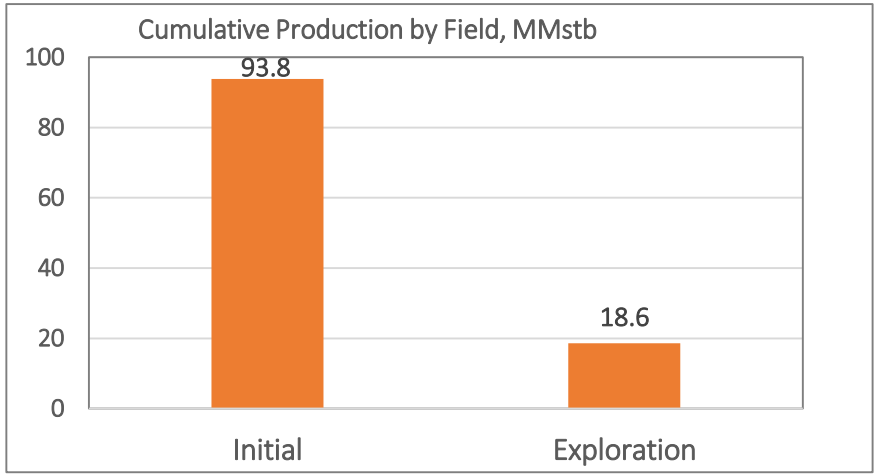
Kuwait Energy

“Area A” Fields Overview

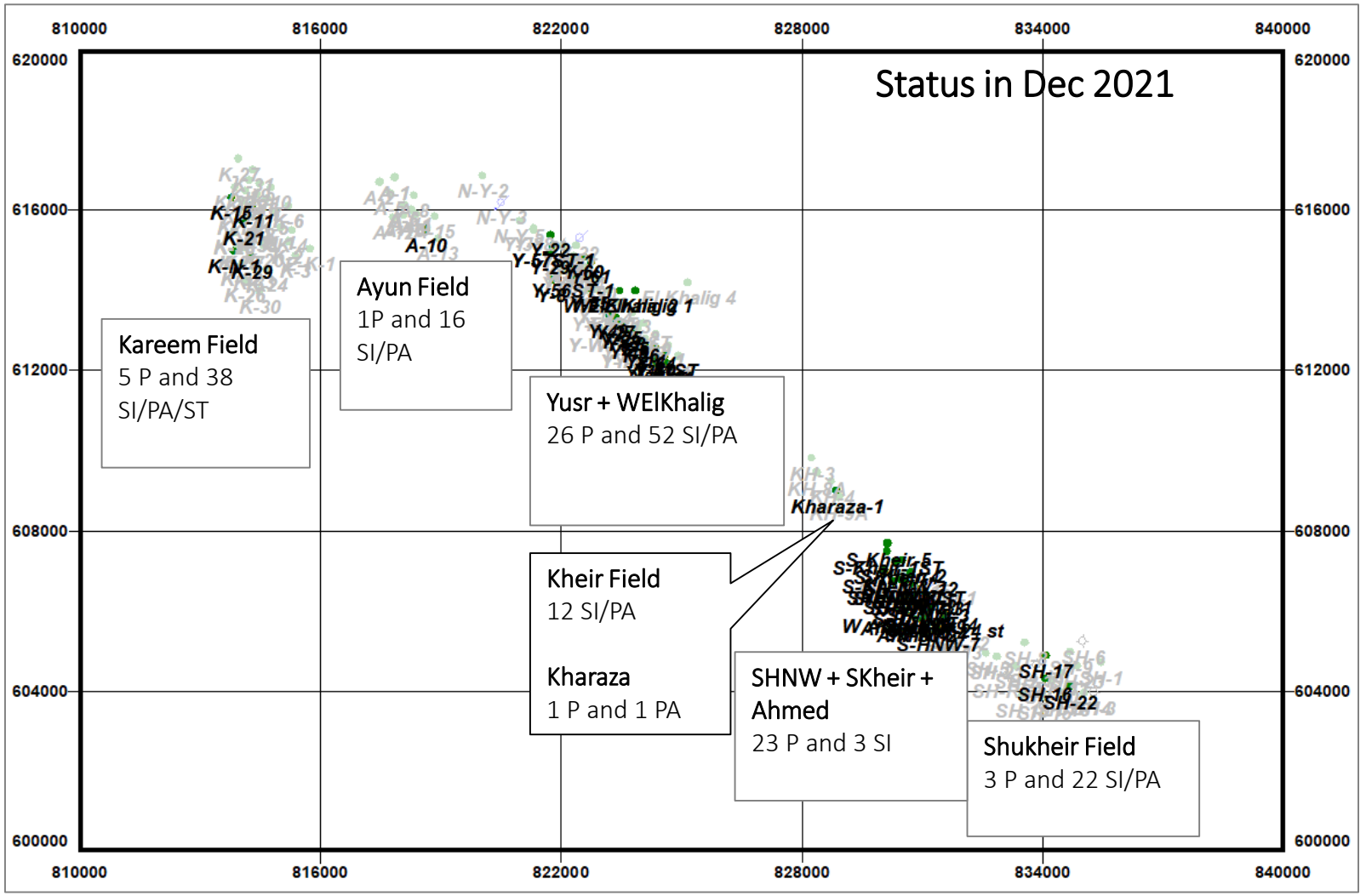
- Discovery Date: 1958
- 300 km2 in western onshore area of the Gulf of Suez
- Five Ageing Brown fields (Initial Fields) and Exploration Area
- Total number of wells is 250 wells
- Seven producing reservoirs
- Cumulative production is 112 MMstb
- Owner : The General Petroleum Company (GPC)
- Agreement Type: Revenue Sharing Service Agreement





“Area A” Fields Overview

Shut-in (SI) wells in Area A represents 76% of **total** number of wells and distributed all over the field



Importance of re-entry of old SI wells

- Add new oil: Contractual baseline is the oil that was produced at time of issuing the Agreement license with agreed decline rate applied for it. Therefore, shut in wells were not included in Baseline rate.

“Re-entry SI wells can get new oil that was not considered before”

- Add Reserves: Brownfields are best matched by decline analysis and that is main factor in reserves calculation

“Adding oil from a SI well represents higher start point from which decline will go and hence increase reserves”

- Rejuvenation of old fields: Number of producers in Jan 2015 was 48 wells. During 2015-2021, KEE drilled 16 successful wells. However, 11 wells were closed for being watered out with no more options. This will end up with 53 wells. However, current number of producers are 59 wells and this is because of successful re-entry of SI wells **“Re-entry SI wells can keep fields running longer”**
- Developing ideas and opportunities: Applying an idea can open room for other workover jobs or drilling wells

“Re-entry of SI wells can unleash potential of the field”

Main reasons for wells being SI

Main reasons for SI wells in Area A are (No pay – Limited pay – Watered out – Below current contact – tested water/high water cut – postponed production – Bad CSG integrity)

Or should we say?

“Thought to be/have” (No pay – Limited pay – Watered out – etc.)

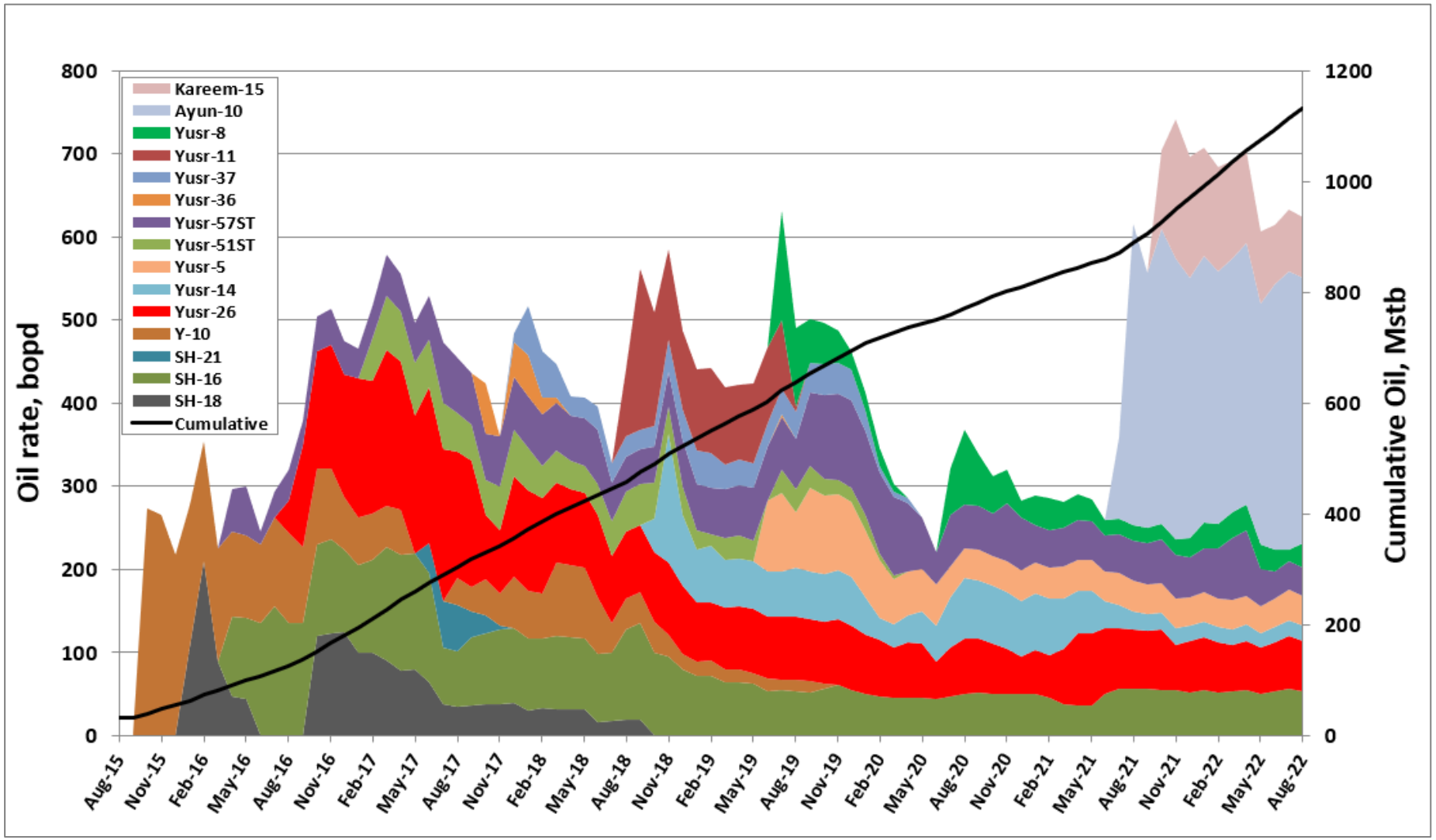
GPC 1960 – 1990 staff are the pioneers of petroleum sector in Egypt and well-known for technical excellence which is clearly observed from the exploration and development efforts/actions in Area A.

Bringing/Searching for oil after GPC is challenging, but at the same time interesting and rewarding experience

"Where oil is first found, in the final analysis, is in the minds of men" (Pratt, 1952)

Gain from re-entry of SI wells

Opened 15 SI well: Up to date cumulative is 1.1 MMstb – Current rate is 630 bopd



Considerations to select a re-entry opportunity

- Integration of data from multiple source and thorough analysis in light of recent enhancements in subsurface realization
- Keen eye for details has main role in noticing and capturing effectual givens
- The key is to uncover the clue that encourages performing the WO; meanwhile, subsurface data supports presence of oil left in the targeted zone and right operations can be tried to access this zone
- Take the risk. Allocate budgets for unforeseen WO

Examples for clues / Lessons learned

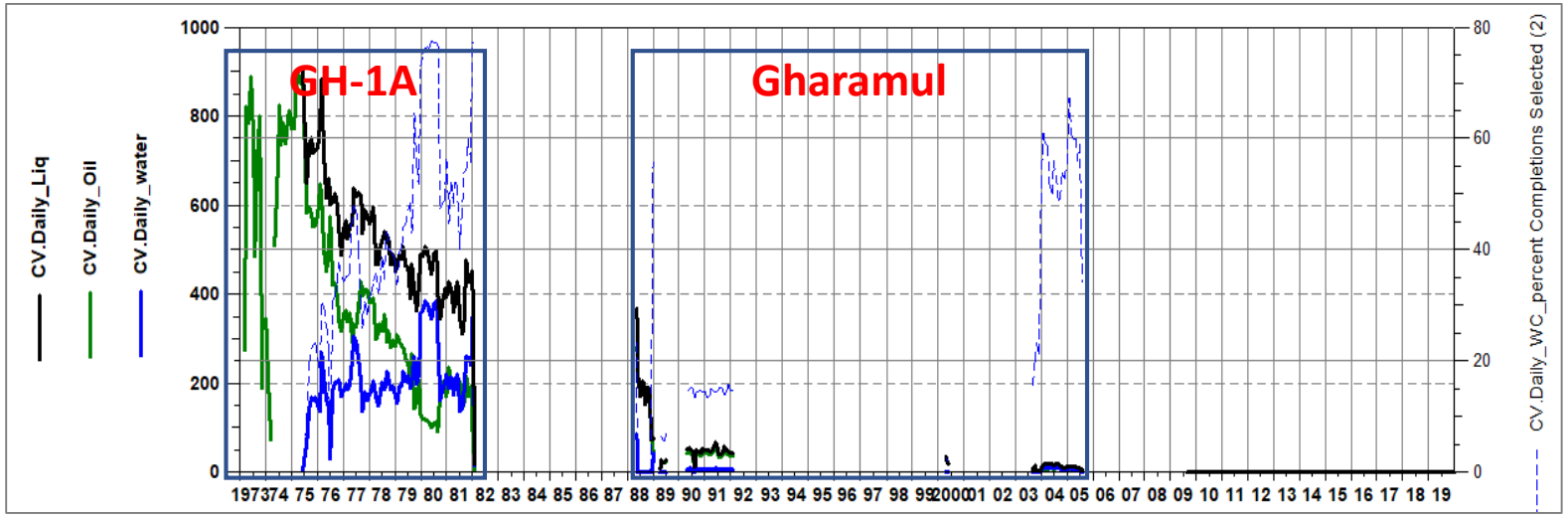
- Overlooked a zone in order to produce another clear pay – Example Ayun-10
- Repeat your analysis as you may notice something was not noticed before – Example Ayun-10
- Perform your own interpretation and judgement – Example Yusr-26
- Well integrity and facilities condition are important factors to consider – Example Kareem-15
- Non worthy production for others can be worthy for us – Example Yusr-8
- No OH log/petrophysical analysis doesn't mean no pay – Example Yusr-11
- Reliability of the test is more important than the test result – Example Yusr-37

The next section discusses briefly re-entry jobs in 2021. It focuses on operations/reports of the well and the clue for being a candidate for WO. It will not include subsurface data (geology, reservoir, and petrophysical) analysis

Re-entry of SI wells in 2021 – "Ayun-10"

Brief History:

- The well was drilled in Jan 1973 to total depth of 1131.6 m



GH-1A (884 – 894)

- Started production in 1973
- Watered out in 1982 after cumulative production of 1.3 MMstb.
- After 5 years (1987), RIH with pump for one month and showed formation water so isolated the zone

Gharamul zone (1033 - 1050)

- In 1988, tested 370 bopd after acid stimulation with many pump stuck due to sand from CSG leaks and GH-1A

CSG Repair

- 1988-1989, 5 CMT jobs to repair CSG + 5"CSG installation

Gharamul zone (1033 - 1050)

- In 1989, tested and stimulated and showed low influx
- In Aug and Dec2003, add perforation, reperforation, two stimulation jobs and showed low influx.

Re-entry of SI wells in 2021 – "Ayun-10"

1- First impression:

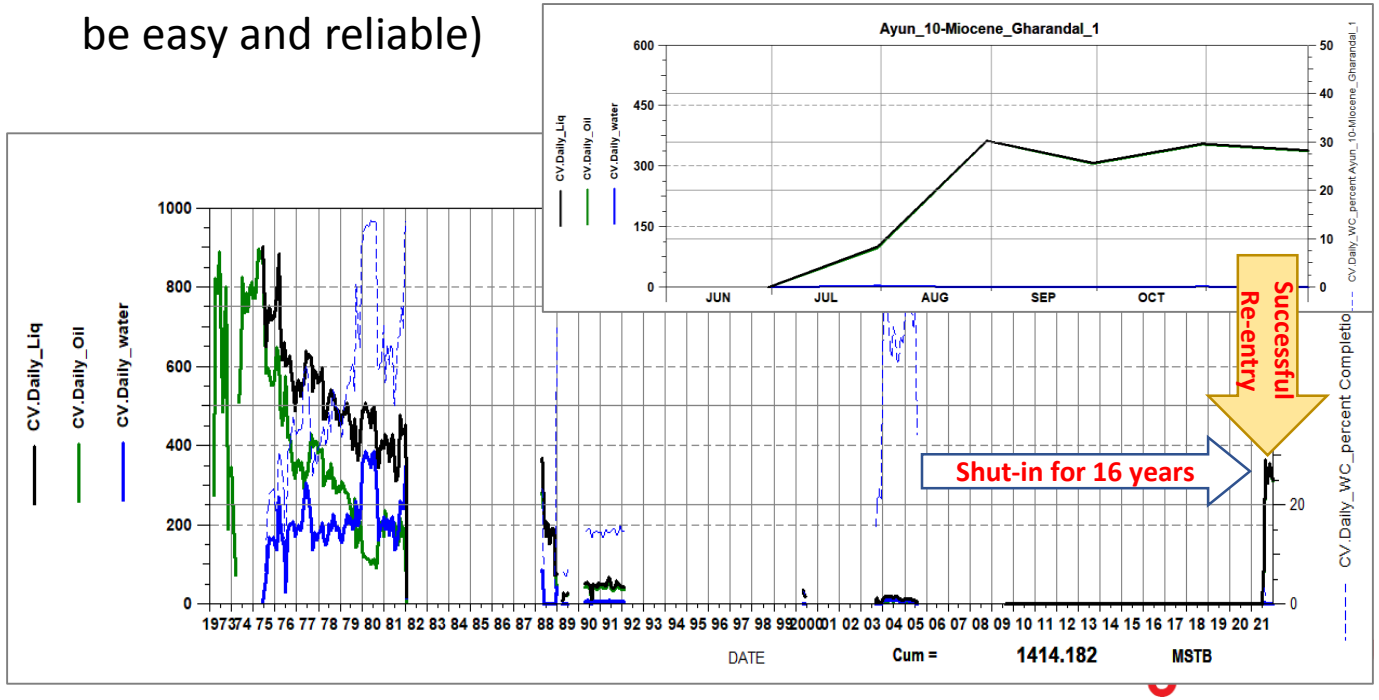
Gh-1A

- Watered out in 1982 and after 5 years (1987) used pump for one month and resulted in water only
- Isolate and go for clear pay in Gharamul

2- Where is the Clue?

GH-1A

- 1987 Repeated pump stuck (enclose doubts to reported result)
- TDT in 2003 (Sigma curve representative for Sw showed possible oil left in top 2 meters)
- CSG leak detection (**Main Clue** because it means that any previous water test result is doubtful)
- Running 5" CSG to cover Gharandal (performing a test now will be easy and reliable)



3- Action Taken and Result:

- Performed isolation by PKR and used deep penetration guns to break through 5 previous cement squeeze jobs and 2 casings

- In Jul 21, the well was perforated in top 3.5 m in GH-1A and showed 350 bopd

Re-entry of SI wells in 2021 – "Kareem-15"

Brief History:

Bottom Turonian (701-714.5) m

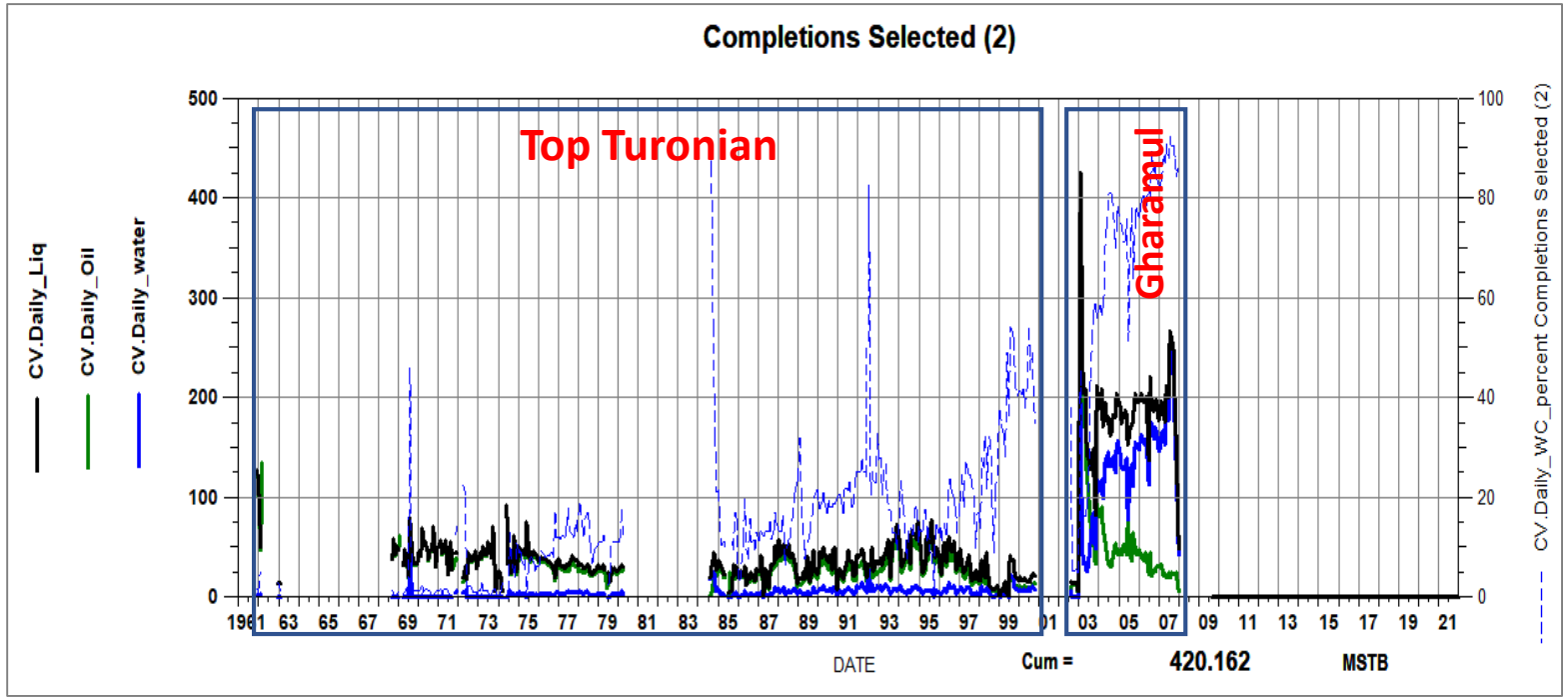
Sep-1961: acid stimulated, lifted the well got average oil and water rate 120 BPD w/ 6 % WC. After two months, it was decided to isolate with BP because there was no facility for water separation.

Top Turonian

- Six intervals between 625 – 676 m
- First tested in Sep 1961, kept SI till 1968
- Cumulative 317 Mstb till watered out

Gharamul (551-566) m

- Perforated in Dec 2002
- Cumulative 102 Mstb till watered out



Re-entry of SI wells in 2021 – "Kareem-15"

1- First Impression:

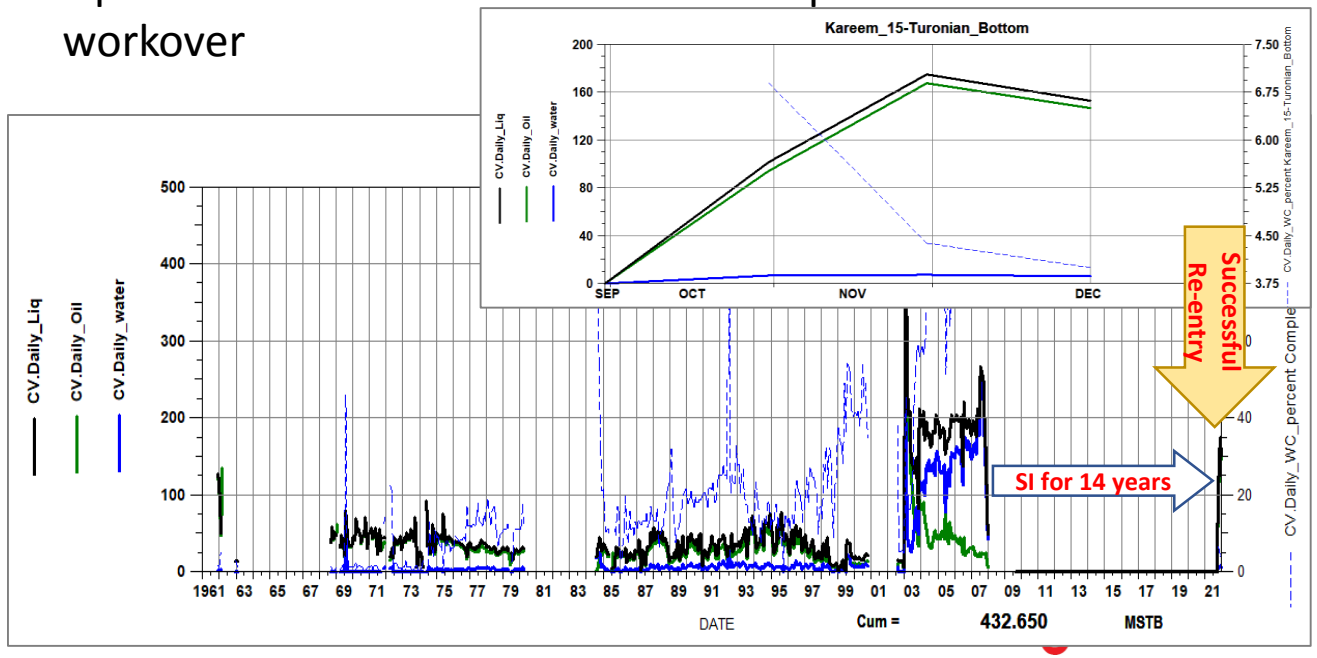
Bottom Turonian

- The well tested 6% WC only (7-10 bwpd). However, GPC decided after two months to recomplete the well. Therefore, it seems that WC% increased to the limit that it can't be handled
- Accessing such zone will require hard operations as follows: Fishing 7" BP– Fishing 5" slotted liner – Drilling 7" CMT plug – Fishing limit plug (old plug with no configured/known shape) – Drilling 9 ½" CMT plug

2- Where is the Clue?

Bottom Turonian

- Historical production of Area A shows that there is no water production till 1964. This can mean that GPC didn't install water separation facility till 1964. Therefore, there is opportunity that Bottom Turonian got the same low WC% in the two months
- Operations set a clear and definite plan to conduct the workover



3- Action taken and Result:

- The job operations were completed successfully
- The well was put on production in Oct 2021 with 170 bopd and 4%WC

Conclusions

- Re-entry of shut-in (SI) wells is gaining special attention because it can add new reserves, production and un-lock new opportunities
- Re-entry of SI wells requires thorough data collection and interpretation, uncovering the clue to the presence of left potential and the right operations to reach the target
- Re-entry of SI wells usually involves high risk and significant challenges to the extent that it is considered as having unforeseen results. However, it is considered a rewarding experience and deserves to allocate budgets for execution
- During the period 2015-2021, 15 wells were opened. Their current oil rate is 630 bopd and made cumulative of 1.1 MMstb
- Two successful re-entry jobs were performed in 2021 for Ayun-10 and Kareem-15 adding oil rate of 450 bopd

Thank you very much