

Improving Existing Perforations Efficiency with P3 Dynamic Underbalance Technique Enhances Productivity

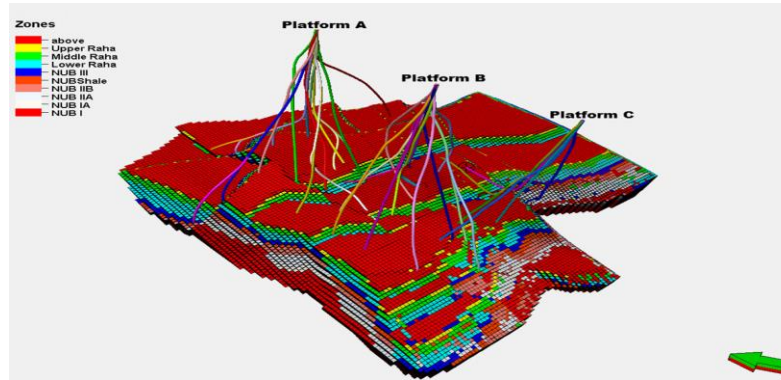
Case Study in Ras Budran Field; SUCO-GOS



Schlumberger

Ras Budran Subsurface Overview

Reservoir Units
Matulla
Upper Raha
Middle Raha
Lower Raha
Unit III
Lower Unit III
Unit UIIB
Unit UIIA
Unit IA
Unit I



General Information

Location: North Belayim offshore Area

Discovery: **1978**

1st production: February 1983

Offshore Facilities: 3 Offshore Platforms (A, B, C)

STOIIP: 830 MMstb

Cum. Production: 294 MMstb

Recovery Factor: ~35%

Reservoir Data

Reservoir Formation: Nubia, Raha, Matulla.

Formation Type: Sandstone, & Carbonate.

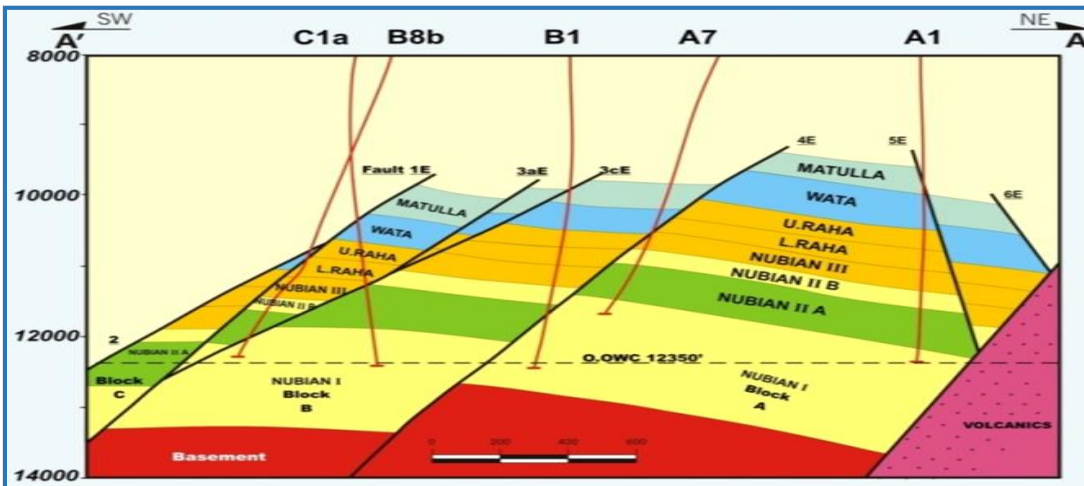
Formation depth: ~9500 ft

Reservoir thickness: ~ 2100 ft

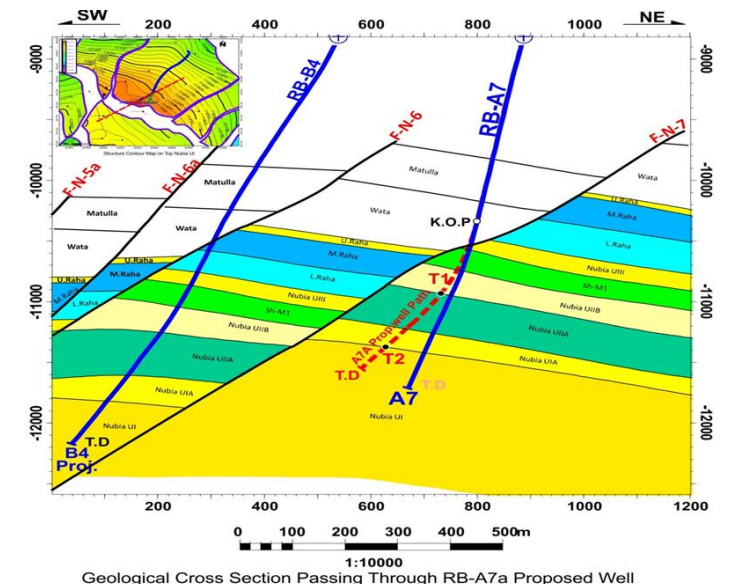
Permeability: 40 - 340mD

Porosity: 9 - 15%

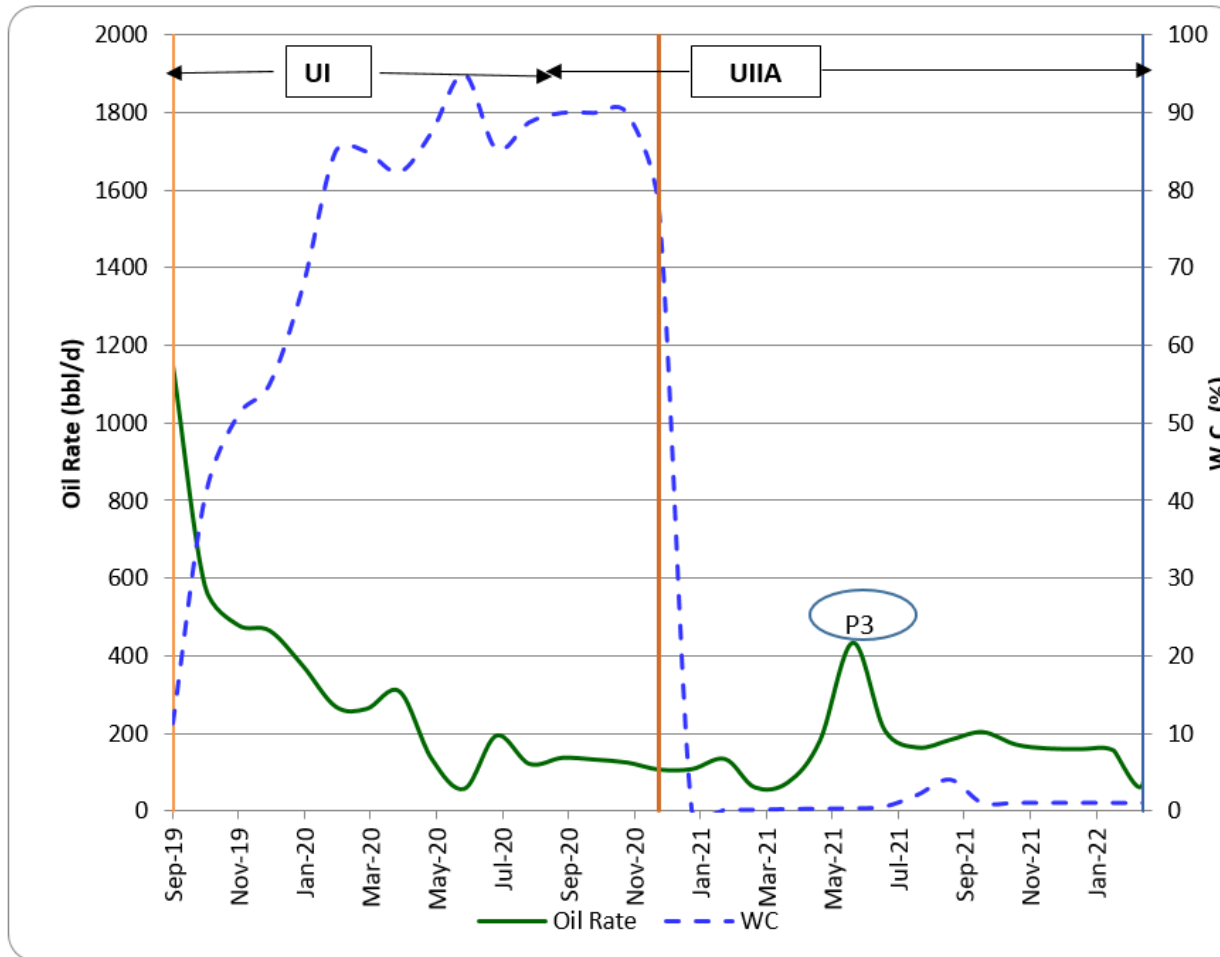
Oil Gravity (API): 19 – 26



-
- Nubia U.IIA**
- 11500
- 11600
- 11700
- Nubia U.IIA**
- Nubia U.IIA**
- 11485 37.89 55.09
- 11564 38.02 73.26



Ras Budran A7a



RB-A7a started production in September 2019 from deeper reservoir unit (unit I). Followed by additional perforation in January 2020 in unit IIA

The well showed steep decline reaching 50 bopd.

Re-Perforate the existing perforation without any improvement. Isolate the lower unit in December 2020. Perforate additional interval in Unit IIA.

Water cut dropped to nill with maximum production of 200 bopd.

Added additional perforation using P3 in May 2021, with a peak of production 400 bopd

Perforation Selection: The driving factors for the optimum result.

What type of formation?

What are the bottom hole conditions?

Presence of Scale, Fines migration, organic deposits?

Is the formation damaged?

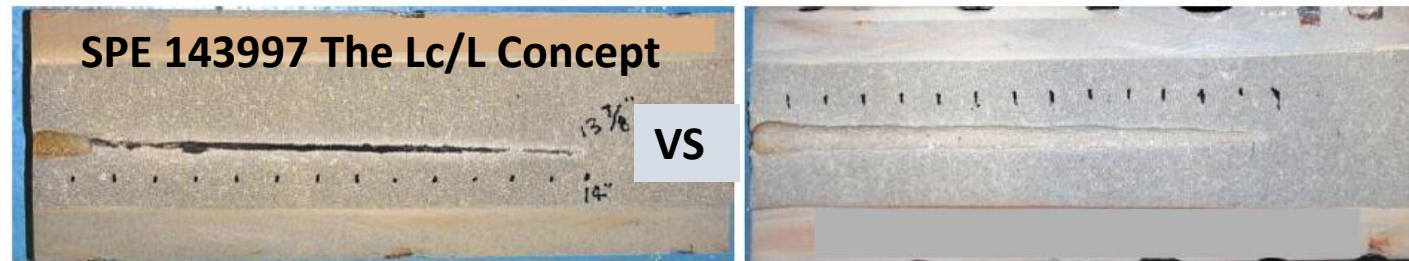
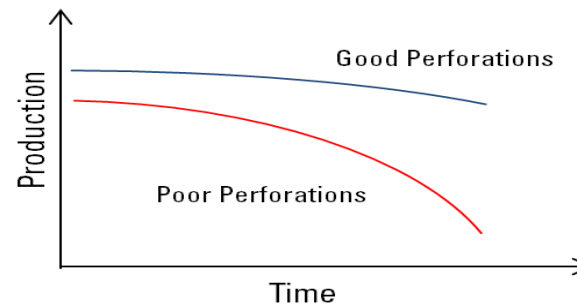


Fig 2. Photographs of perforated cores. (left) Zero DUB (or dynamic balanced – DB) core; (right) DUB core.

Completion Type? Minimum restriction? Rig less? Workover?

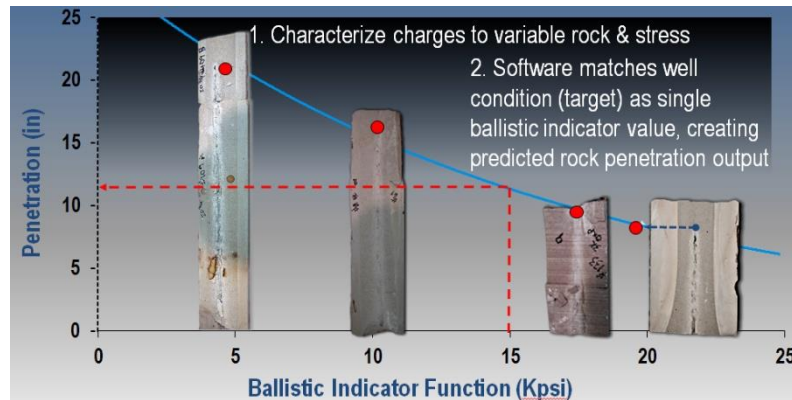
Reservoir Characteristics: Permeability, Porosity, UCS, Pressure?



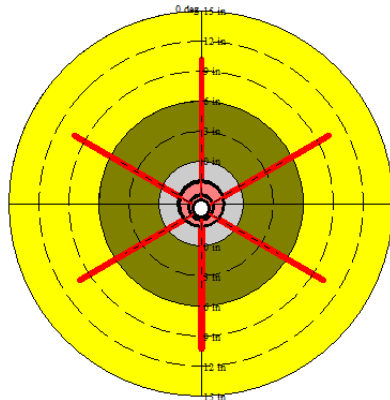
Producer/ Injector, Natural Producer or Artificially lifted?

RB-A7a perforating strategy selection criteria

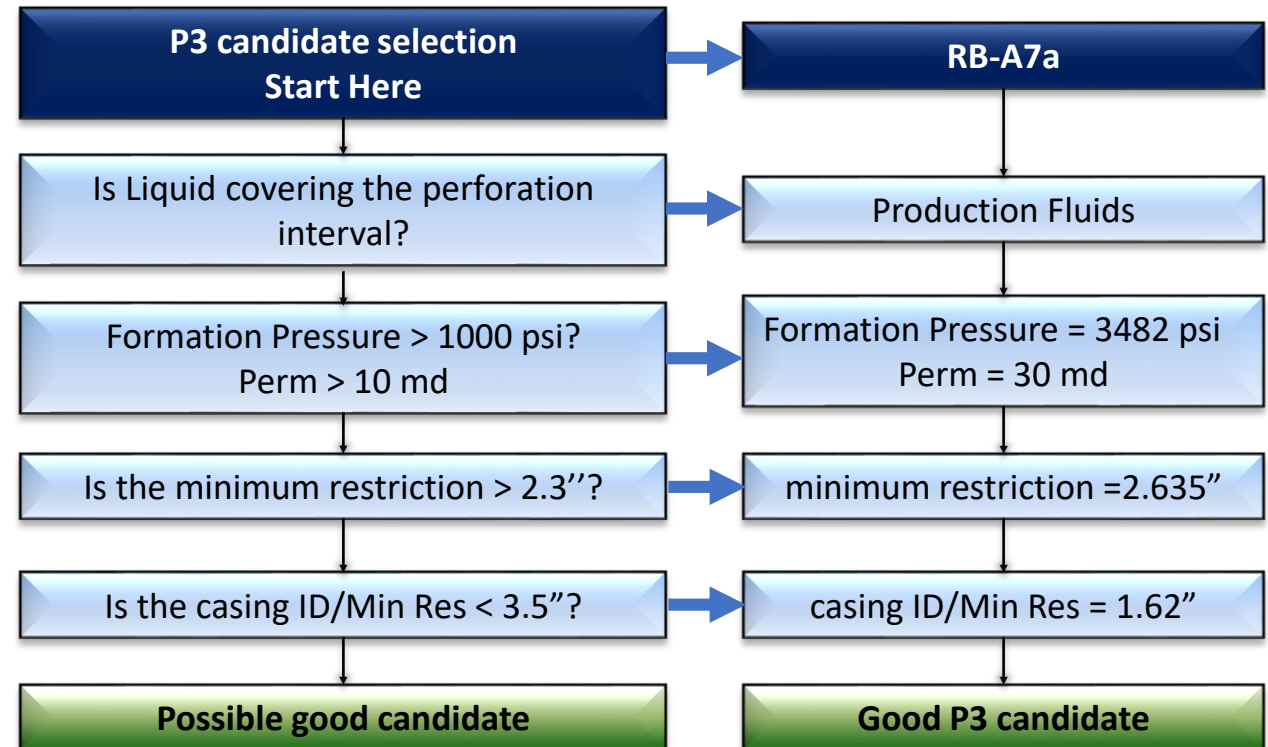
1. Need to select the deepest penetration gun/ charge for well conditions and reservoir characteristics: completion presence, rig less job, minimum restrictions, rock type, UCS



Simulate well utilizing SPAN rock software, API 19B Section 2

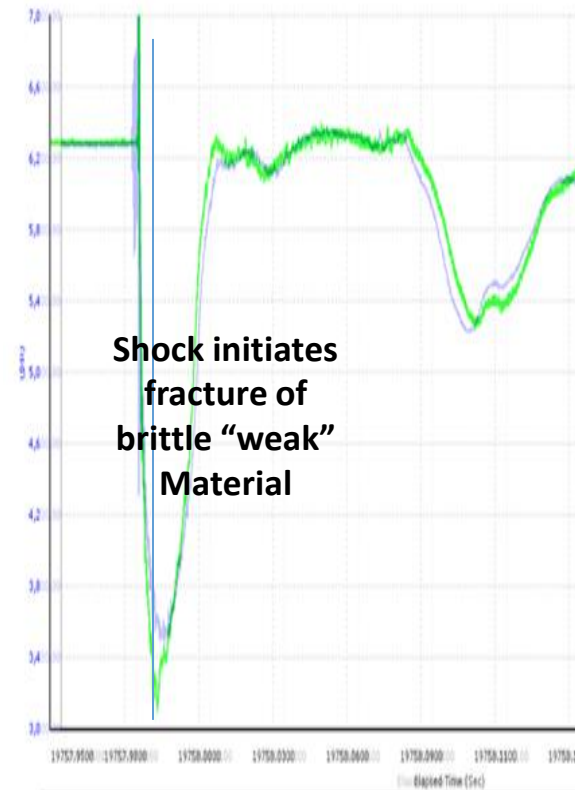
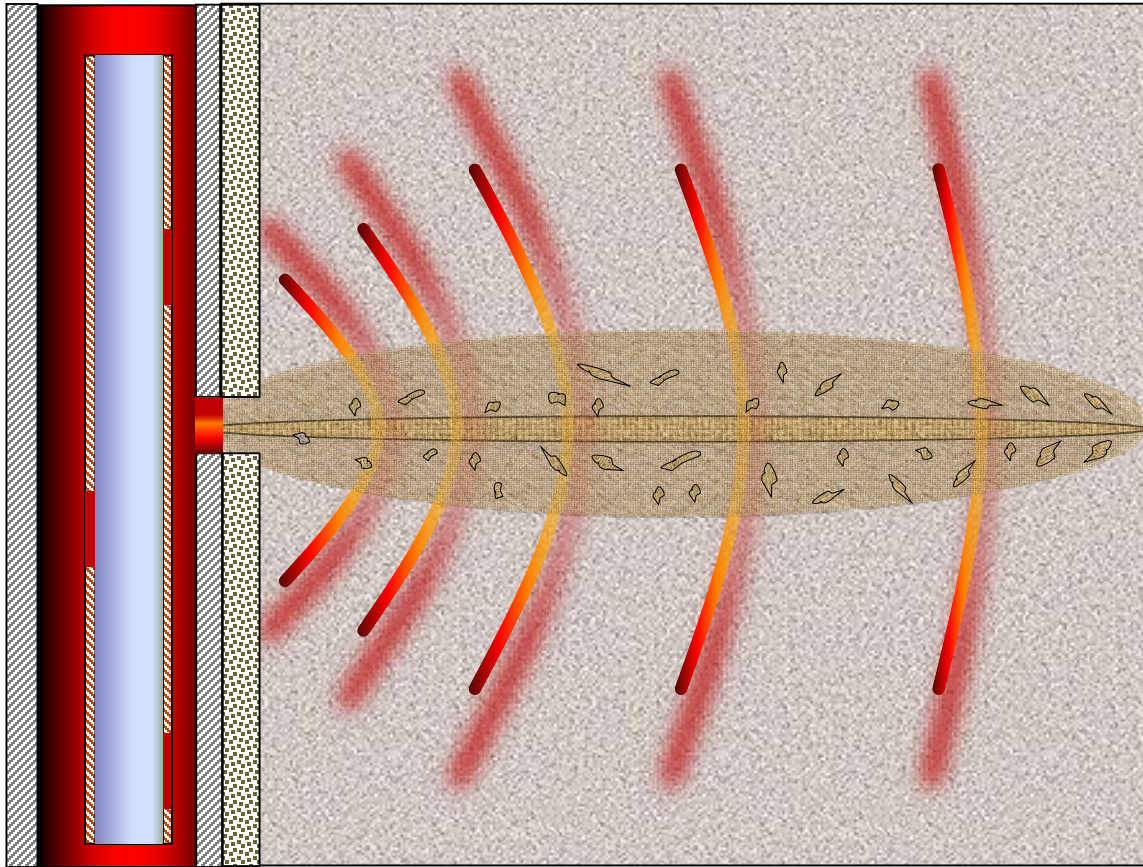


2. Perforation Tunnel needs to be cleaned for improved productivity: simulate effect of conventional perforation, static underbalance, dynamic underbalance, and dynamic underbalance implosion technique and compare productivity results.



How does P3 works

An implosion chamber is placed across the interval to be treated, the chamber is opened, and material removed from tunnel.



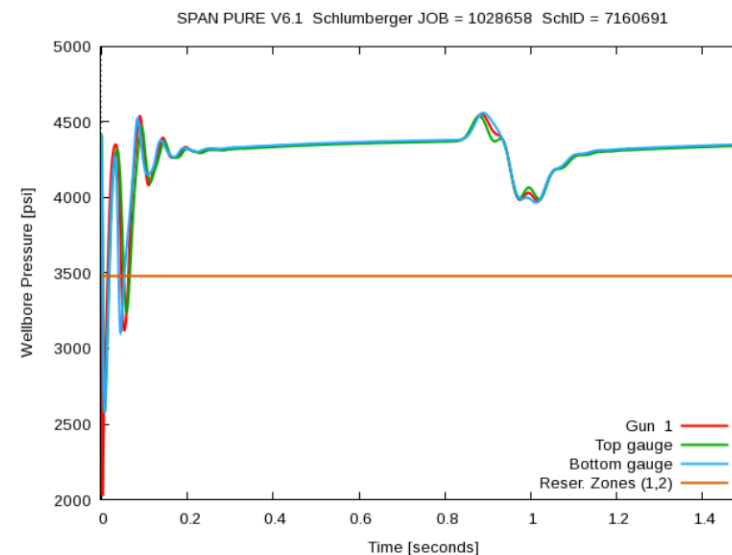
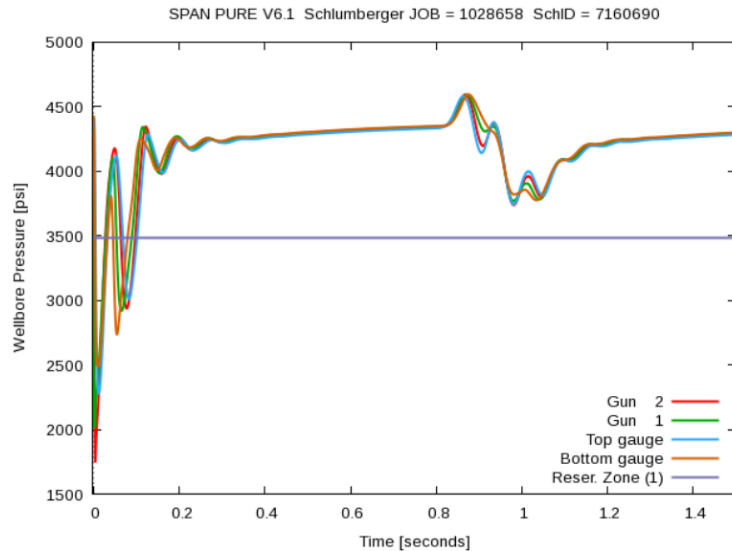
P3 is does not open new holes in the formation.

P3 uses special shaped charges to create an implosion downhole

The objective is to create a local implosion (fastest possible drawdown) to clean debris from existing perforation tunnels

P3 requires sufficient formation pressure and formation permeability

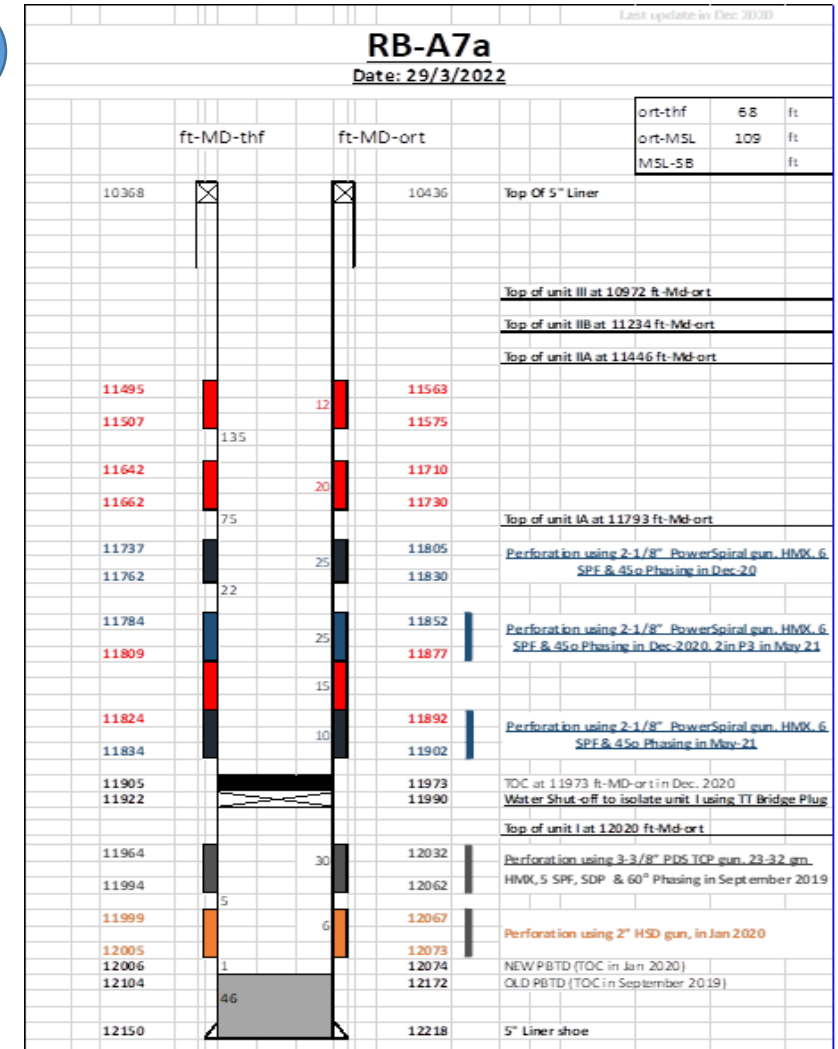
RB-A7a perforating strategy simulation and design



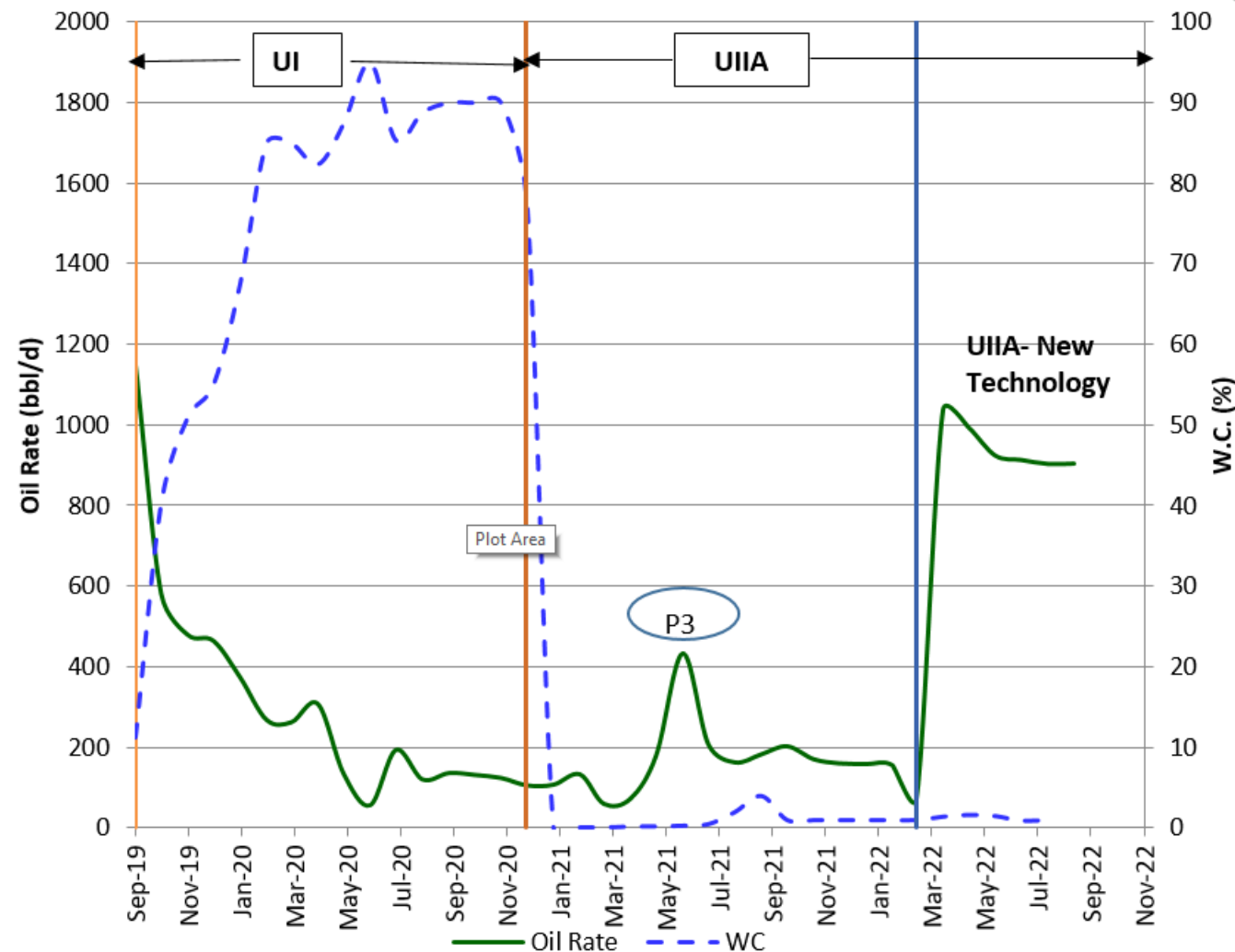
Add perforation across UIIA (11710 to 11730, and 11563 to 11575) ft-MD-ort.

Add perforation across UIA (11877 to 11892) ft-MD-ort

Perform PURE P3 for the open perforation in UIA (11852 to 11902) ft-MD-ort.



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Additional perforation in unit IIA were added in April 2022 using new technology (**Schlumberger P3 and Powerjet Omega 2" gun**).

The Major Achievements:

- Initial target of commercial production from UIIA in Block A & B for the first time. (Produced till now 1.5 MMBBL).
- Add additional **60 MMstb** to the field STOIP and succeeded to **double** the remaining reserves for the field.

