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Optimization of Production Scenario in Jambaran Field to achieve Operation Excellent in Cepu Block

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Abstract

A huge gas field development will be implemented in Cepu Block with the target is carbonate build-up reservoir in North East Java Basin. The Jambaran reservoir is at present in the saturated phase that contains both oil rim and gas column (gas cap). An ultimate strategy in developing this field is the key to the success of this project's future due to the agreement with end user to deliver gas that produced from gas cap has been contracted. Therefore, all aspects of planning and strategy including subsurface, drilling and completion by considering any potential hazards from geological, drilling, and HSSE point of view need to be prepared perfectly.

In terms of reservoir and future well surveillance plans, there are several aspects needed to focus on, such as production scenario. Around 600-800 ft. thickness of prospect zones will be perforated and produced in order to meet the optimum production per well which is estimated about 45-60 MMSCFD and the well can be optimally interfered in the future, so that in the associated production zone will be installed casing or liner. Hence, the selection strategies that will be applied become very crucial which the cased hole production strategy itself can use slotted liner or cased & perforation.

After conducting some optimization and by considering the time, cost and safety effectiveness, finally the option of cased hole with perforation is chosen. In addition, the casing design that will be manufactured and the ability to interfere the wells, if necessary, can be fulfilled by this choice. On the other hand, with a profound study, there are two options for perforation strategy: wireline perforation and coiled tubing conveyed perforation. The critical aspect in evaluating the two methods is the safety factor of perforating 600-800 ft. zone. The reason is the reservoir contains sour gas with H_2S and CO_2 level reaching 1% and 35% respectively. If selected perforation method is not suitable, the fatality such as blow out or leak during perforation will be difficult to avoid.

Keywords: *Jambaran Field*, *wireline perforation, coiled tubing conveyed perforation, tubing conveyed perforation*

Introduction

The Jambaran – Tiung Biru Field was discovered in 2001. The discovery well encountered a thick gas column and thin oil rim reservoir in steep-flanked carbonate build-up structure of Oligocene age.
The Jambaran-Tiung Biru reservoir is a steep-flanked carbonate structure with approximately 1,000 m (3,281 ft) of relief relative to the surrounding platform (Figure-1). The main carbonate build-up is approximately 10 km length and 1 km width. 6 wells have been drilled on the Jambaran-Tiung Biru discovery, 3 wells J-1ST1, J-2, J-4ST4 at the eastern and 3 wells T-1ST1, TB-2ST1 and T-3 at the western end of build-up.Jambaran-Tiung Biru is one of several carbonate build-ups on a larger carbonate platform. Some of these carbonate build-ups have been drilled and can be used as analogs to help constrain the Jambaran-Tiung Biru geologic concepts.

As with gas development, a gas sales agreement was signed to deliver gas at an annual rate of 315 MMscf/d for a 16 year plateau duration. This commitment must be met upon the duration of the contract to avoid penalties that will harm the overall project economics.

Development Plan

Further simulation studies concluded that the total of 6 wells with 800 ftmd perforation interval will be most optimal economically & technically (Figure-2) to deliver the projected gas production (45-60 MMSCFD/well)

To maximize project economics these 6 wells will need to sustain productivity upon the duration of the production plateau. In order to meet the target plan, a robust completion plan is needed. Such a plan will need to carry out:

1. Real time well pressure monitoring
2. Future well intervention / workover
3. Delay liquid production

Other challenges that need to be known are drilling & material, a deep sour gas reservoir with historical total losses during exploration drilling will be further reasons of why an additional new drill well (Out of the current 6 planned development wells) will not be economical to the project.

Data and Method

The data are used from 2 exploration wells (J-1ST1 & J-4ST4) which consist of wireline logging, conventional core and well testing data. The methods used for optimizing the JTB field development plan for Operation Excellent in the Cepu Blok are:

1. Completion design optimization
2. Perforation strategy of 800 ft HC zone.

Strategy and Discussion

The discovery wells, J-1ST1, is located approximately 6 km south of the Banyu Urip Field. The hydrocarbon accumulation extends into the adjacent Pertamina E&P PSC and connects with Tiung Biru Field.

The Top Carbonate Envelope (TCE) structure map of the Cepu Block shows the regional configuration of the Oligo-Miocene carbonate platform and associated carbonate build-ups, including the Jambaran-Tiung Biru structure. The build-ups can exhibit several thousands of feet of relief from the

regional carbonate platform. Their growth history, structural form and rock properties are similar.

Two wells, J-1ST1 and T-1ST1, define the eastern and western ends of the buildup respectively. A third well, J-2, was drilled to know the north area of the build-up, where it penetrated a thick detrital carbonate interval overlying a shallower water platform carbonate. The most recent wells – J-4ST4, T-2ST1 and T-3 - have been drilled along the structure between J-1ST1 and T-1ST1 and confirm the field interpretation (Figure-3).

Challenges

The biggest challenge in developing the JTB field is the high concentration of H2S as high as 1% and CO2 of 33%. Partial loss & total loss zones are also present from lesson learned on previous exploration wells.

Completion Design

For production optimization in the JTB field, there are different options of whether to complete the well with cased & perforation, slotted liner or open hole production. In Figure-4, it shows the assessments that have been done regarding to the well completion design.

With regards to HSSE and technical aspects, it was decided that the best well completion design is cased hole & perforation scenario. This is due mostly to the fact that the well is needed to sustain the 16 year plateau period with annual production of 315 MMScf/d. The completion design for the JTB field is shown in Figure-5.

Perforation

The main reservoir in Jambaran-Tiung Biru Field is Top Carbonate Envelope (TCE) Formation with approximately 1500 ft thickness. The top part of reservoir is ± 400 ft (8,509 – 8,896 ft) thick and its porosity is around 13.9%, while the good quality part is on depth 9.997-8,896 ft (± 1,100 ft) with porosity is around 22.6%. To fulfill total gas production target, the perforation interval is needed to be around ± 600-800 ft and the bottom perforation interval must be 300 ft beneath GOC zone to reduce water conning while production in the future.

The perforation strategy becomes very crucial due to the length of perforation interval. Two options were chosen to complete the perforation; using electrical wireline logging and coiled tubing as the gun conveyance. Comparison has been made to decide which the most feasible and safest method is as can be seen in Figure-6.

Based on perforation strategy analysis using either electrical wireline logging or coiled tubing, as can be seen in HSSE aspect, coiled tubing is considered as safer option.

CONCLUSION

1. The chosen completion design for Jambaran-Tiung Biru Field development is using cased hole perforation
2. The perforation strategy will use coiled tubing as its conveyance, which is more efficient in drilling operation days aspect, compare to Electrical Wireline Logging

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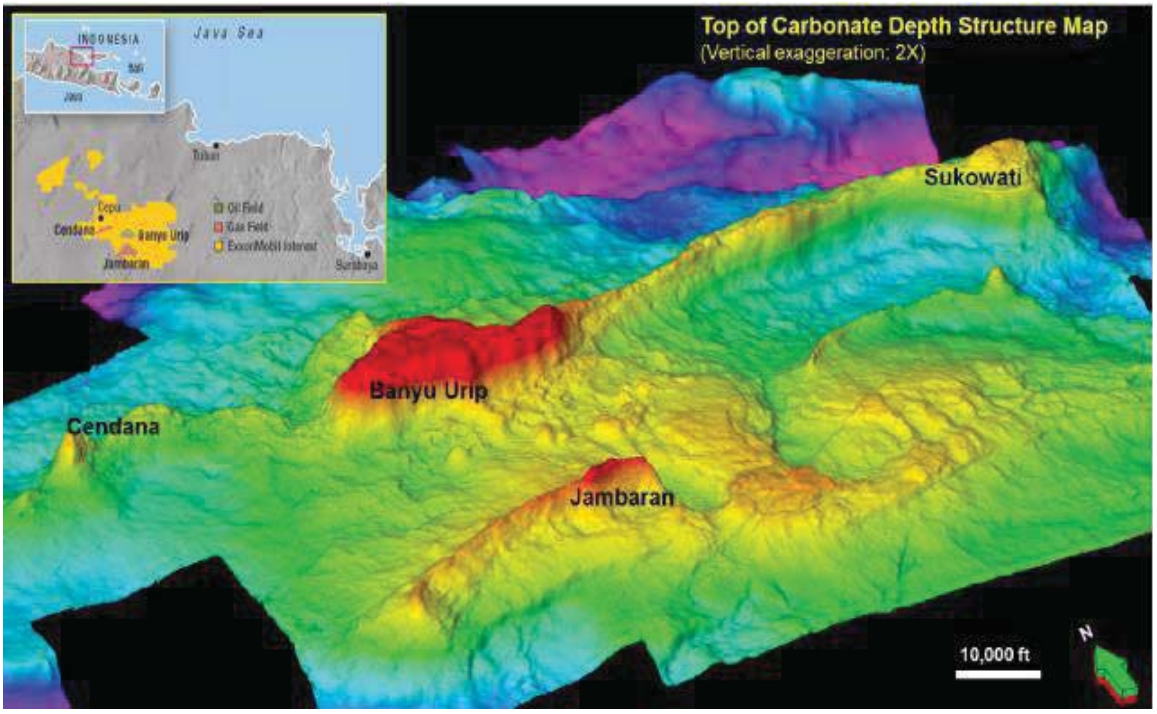

Figure 1. Location Map showing structure of Top Oligocene Carbonate Jambaran-Tiung Biru Field.

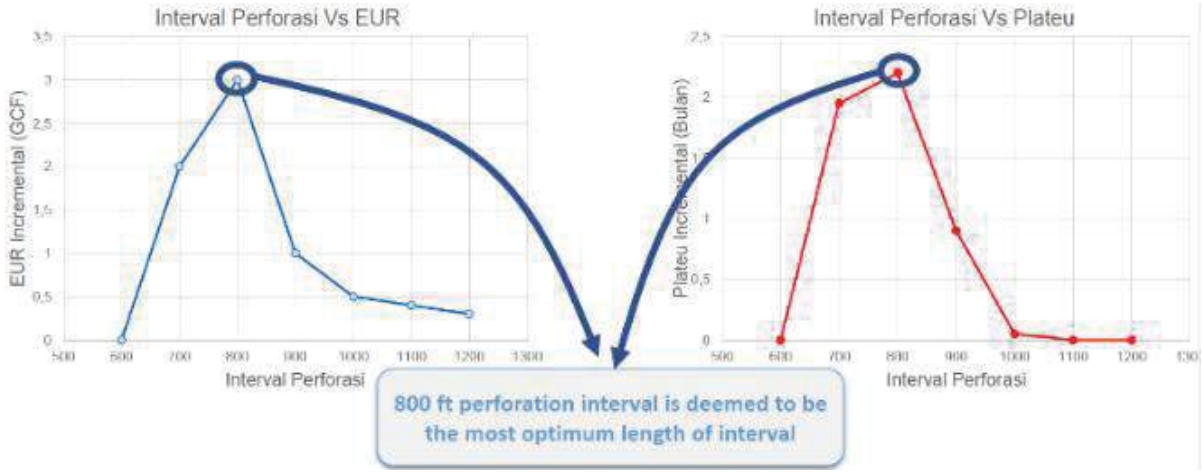

Figure 2. Perforation Interval Sensitivity

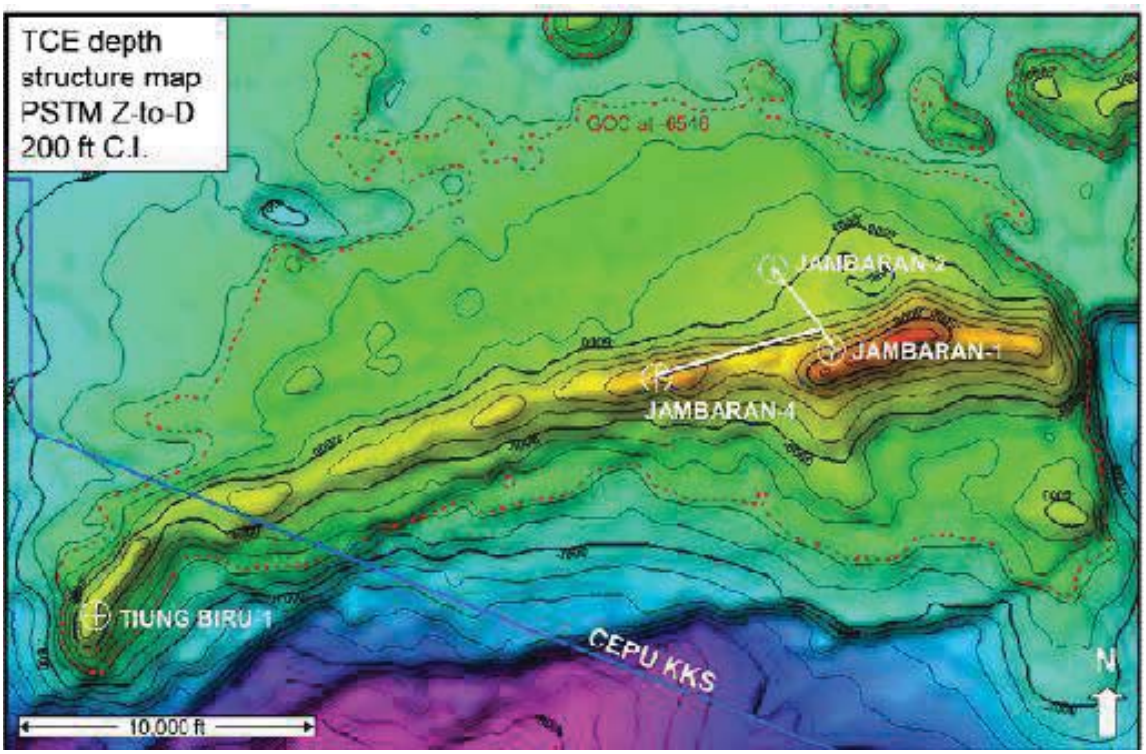

Figure 3. JTB Top Carbonate Depth Structure

Remark	Completion Design		
	Cased & Perf	Slotted Liner	Open Hole
Hole Integrity	Best hole struktural Integrity	Good hole struktural Integrity	Worst hole struktural Integrity
Acidizing	Can pinpoint potential zones	Can pinpoint potential zones	Bull heading
PLT	Normal Operation	Normal Operation	Difficult
Water Shut-off	Able to conduct water shut-off	Able to conduct water shut-off	Difficult
Well Productivity	Moderate	Moderate	High

Figure 4. Completion Design Comparison

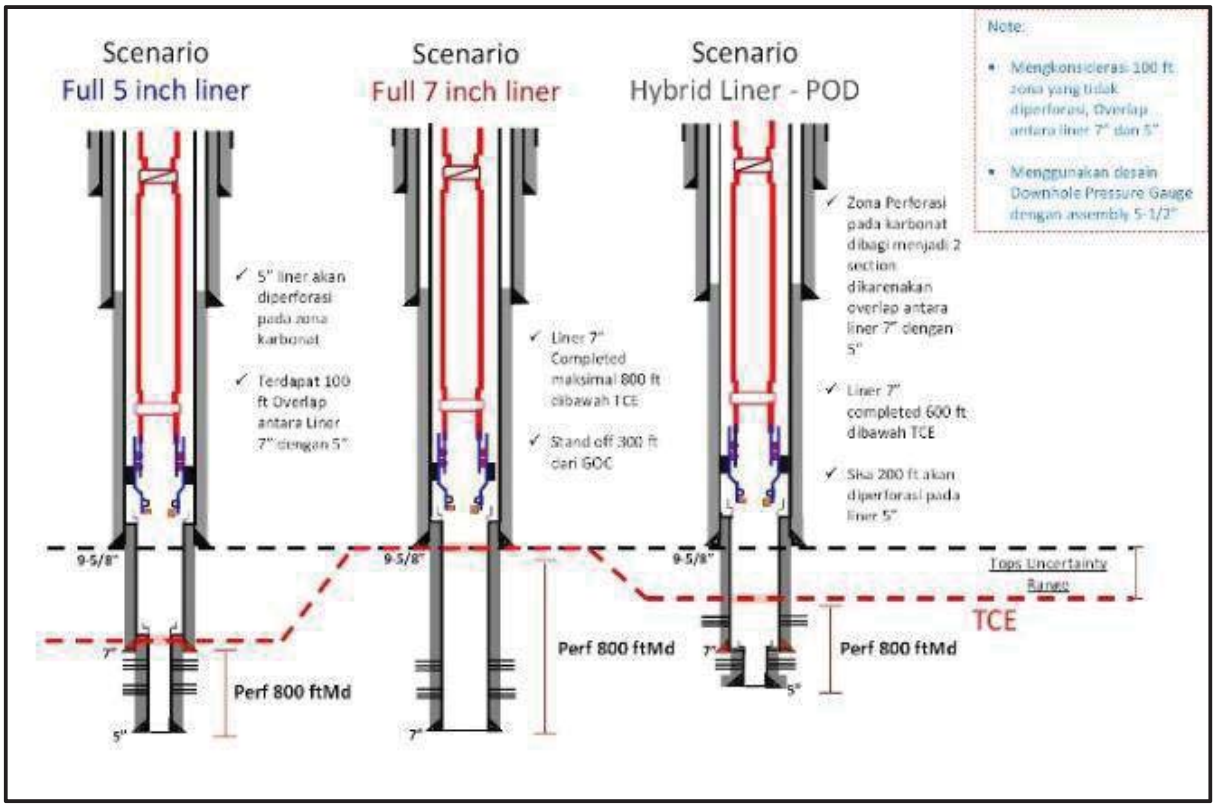

Figure 5. Completion Design of JTB Wells

Item	E-Line	Coiled Tubing	Kesimpulan
Gun Size	2-7/8" 6 spf	2-7/8" 6 spf	Neutral
Perforation per Trip	Max 20 ft (Tergantung Lubrikator)	Single Trip, 800 ft dalam satu run (-150 ft total gun spacer) = 650 ft Effective Perforation Interval	**Coiled Tubing**
Hydrostatic	40 kali trip, Harus secara Overbalance	Underbalance, Maks 1,000 psi	**Coiled Tubing**
Well Control	Bullhead only	Dapat Sirkulasi dengan CT, Pump Rate yang lebih besar	**Coiled Tubing**
Surface PCE	Standard e-line	Gun Latch BOP dengan CTU Tower	E-line (Lebih Simpel)
Dead Interval	Tidak ada, dapat melakukan perforasi secara selective	4 ft untuk setiap koneksi Gun	E-line (800 ft Effective Perf Interval)
Track Record	Proven (World wide & di Indonesia)	Proven (Secara World Wide)	Neutral
Contractor Recommended Method	No, (High Level of Difficulty, resiko eksposur H_2S yang lebih tinggi)	Yes, (Single trip Perforation, Eksposur H_2S yang lebih minimal)	**Coiled Tubing**
Additional Benefits	Tersedia di dalam Negeri	Tersedia di luar negeri, dapat menggunakan DAS & DTS untuk evaluasi sumur	**Coiled Tubing**

Figure 6. Wireline Vs Coiled Tubing Comparison