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Well Accessibility Using Electricline Cleaner and Miller: Success Story of PK-Jx at Offshore Field Pertamina Hulu Mahakam

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Abstract

Mandatory step in preliminary well intervention is to check the accessibility to target depth. Occasionally restriction founded and well can't be accessed to target depth. Coiled tubing operation needed to get well accessibility by eliminating sediment. PT. Pertamina Hulu Mahakam developing offshore ultra minimalist platform where coiled tubing operations can't be performed. Hence, sediment elimination method with Electricline Cleaner and Miller unit which fit with offshore minimalist platform concept feasible to be performed in Mahakam Area. PK-Jx is one of Mahakam Minimalist Platform which facing restriction on intervention. Electricline is deployed to clean and mill services which had been provided by conveying a specially designed tool. To keep production optimized, periodic interventions should be performed to remove the sediment. Based on performance, during intervention should be combine the cleaner and miller to get the effective clean out. The sediment will be trap on the bailer above the cleaner or miller tools. This system is simple, cost-effective, safe and easy to handle. Electricline Cleaner and Miller can open well accessibility from 2030-2062 mBRT (28m) with high success ratio and get 100% well accessibility for next intervention. This method has proven having lower operation cost compare with conventional method. The method eliminates mobilization and demobilization from coil tubing operation which is equals to 4 days saving in operation cost with total cost reduction up to USD430,000 per job. This job efficiency is not affecting safety aspect proven with zero accident, and then reducing risk form High Risk to Low Risk due to the elimination of heavy lifting (especially during bad weather) and chemical usage. With success story of PK-Jx, we would like to share this method will be a part of solution with future development of offshore minimalist platform which heavy equipment for sediment cleaning and milling is not feasible.

Keyword(s): Well Accesibility, Electricline, Milling, Offshore, Mahakam.

1 Introduction

Mahakam is a mature field located in East Kalimantan with operation in both swamp and offshore field area (Figure 1). Mahakam have more than 2700 gas and oil wells with maintained production of 550 MMscfd gas and 26.260 Bopd oil. Due to mature field and reservoir distribution in the entire area, to maintain oil and gas production, Mahakam have to produce from many wells that can cover scattered reservoir. Various innovation developed to achieve efficient operation lead to several efficiency. Wells were drilled massively throughout the years with increasing wells being drilled, platform have to continue accommodate the increasing well number. Extensive platform design optimization is required in order to achieve low cost solution to develop these marginal resources (Mubarok et al, 2021). Ultra minimalist platform as appropriate innovation preferable to expand well range to scattered reservoir. The innovation leads to the well intervention team to improve operation following minimalist platform designed.

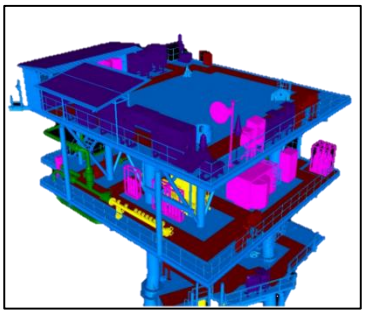


Figure 1. Offshore Minimalist Platform

Figure 2. Scale issue in tubing

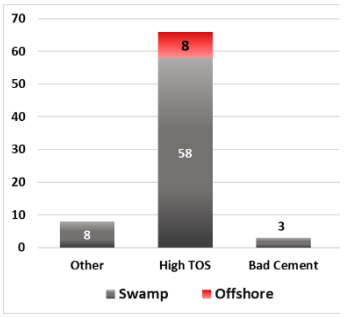


Figure 3. High Top of Sediment Case 2020-2022

Figure 1 above shows offshore ultra minimalist platform which having compact design and smaller than conventional platform. Offshore ultra minimalist platform having quarter smaller size of conventional platform, with top deck space only 220 m^2 compared to conventional platform with 440 m^2 top deck space. Due to well intervention unit always rigged up on top deck, well intervention unit footprint and stack up become big issue when performing intervention.

Figure 2. above shows one of common problem of a well is high top of sediment (TOS) found as restriction while performing well accessibility. This high TOS problem restrict our access to the target depth. Figure 3 shows high TOS statistic from 2020 to 2022 in Mahakam Block with total high TOS problem up to 66 case. Commonly, sediment elimination method can be performed by slickline unit for soft sediment and have to use coiled tubing for hard sediment. Related to minimalist platform deck space issue, coiled tubing unable to perform any operations due to large footprint. This high TOS issue also happened in minimalist platform PK-Jx in Mahakam Block.

2 PK-Jx Problem

2.1 Chronology

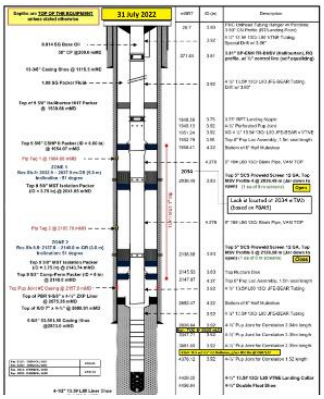


Figure 4. PK-Jx Well Diagram

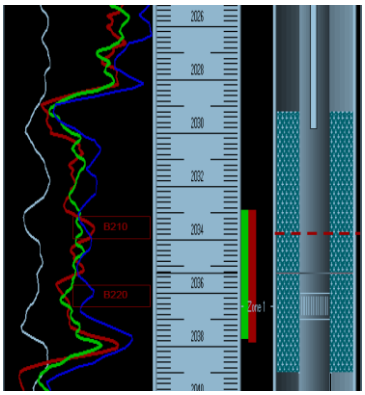


Figure 5. PK-Jx Leak Detection

PK-J well having potential 1.10 Bcf gas stakes left, lately having 10.2 MMscfd and 359 Bcpd condensate. Figure 4 shows PK-Jx completion, completed with combined tubingless and gravel pack completion. The well no flow due to leak at Zone#1 (2034 mBRT) producing water and causing liquid hold up to the well. Previously chemical water shut off (CWSO) performed in PK-Jx at leak SSD Zone#1 (See Figure 5). To perform this CWSO, an inflatable retrievable bridge plug (IRBP) had to set at 30 m below leak depth to allow pumping chemical to leak path. CWSO performed in two batch and considered success. Restriction was encountered when performing well accessibility before retrieving IRBP in CWSO operation. Decided to perform bailing with slickline but found nothing, suspected hard sediment from latest CWSO that was unable to eliminated. Due to several equipment installed at top deck that affect top deck space of PK-J, coiled tubing operation can't be performed at PK-Jx platform. Electricline cleaner and miller used to solve this problem.

2.2 Dimension Issue

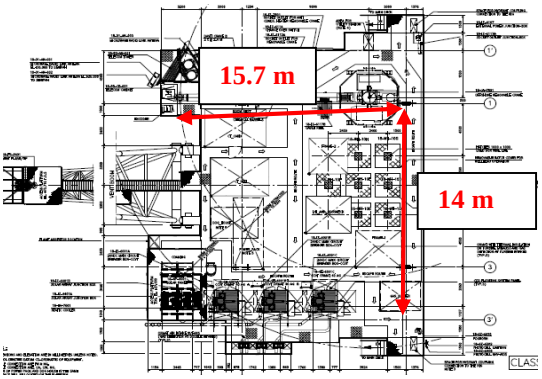


Figure 6. PK-Jx platform dimension

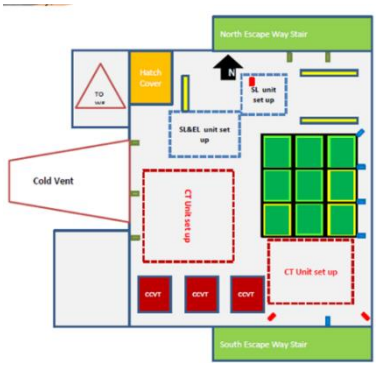


Figure 7. Coiled tubing set up

Figure 6. showsPK-Jx as minimalist platform having top deck space up to 220 m^2. Managing equipment used to support operations is quiet challenging. PT. Pertamina Hulu Mahakam having total 4632 well

intervention job in 2022. Many well intervention option have to be prepared to accommodate all well intervention workload in various well condition and other limitation.

Table 1. Comparison between alternative solution.

Parameter	CT Milling and Sediment Washing	Slickline Bailing	Electricline Cleaning and Milling
Operation cost	IDR8,097 Billion per well	IDR3,420 Billion per well	IDR2,590 Billion per well
Duration per well	14 days	20 days	7 days
Chemical Uses	Yes	No	No
Heavy equipment mobilization	Yes, coiled tubing unit moilization	No, unit available in barge	No, unit available in barge
Complex lifting	High	Low	Low
Reservoir damage potential	Yes	No	No
Milling ability	Yes	No	Yes
Success ratio	80%	20%	80%

Commonly, there are 4 main well intervention unit (Slickline, Electricline, Coiled Tubing, and Snubbing). Table 1 shows comparison between 3 alternative solution. Related to PK-Jx problem, high TOS issue commonly overcome with slickline (gauge cutter, scrapper, pump bailer, etc.) or coiled tubing (jetting and milling). Slickline operation for eliminating sediment have more advantage but limited to sediment type and condition. For harder sediment, coiled tubing has been used to clear restriction. Coiled tubing operation is more expensive than slickline or electricline, besides that coiled tubing also having bigger footprint, heavier equipment and more complex. This coiled tubing disadvantages affect to operation in minimalist platform. Coiled tubing having total footprint on deck up to 150 m^2. Compared to platform size, coiled tubing footprint take 68%% of platform space (See Figure 7). Deck space concern also related to safety for escape way route and house keeping. Coiled tubing reels having heavy weight up to 38 tons. Related to safety, set up unit have to carried out with safe and no rush.

To resolve the problem, we have to use capable unit with small footprint, lower cost and safe. Considered with all the problem mentioned above, electricline cleaner and miller as new potential solution choosen for PK-Jx well. Electricline having footprint 30 m^2, this makes electricline feasible to use in PK-Jx well. Proven saving up to 430 USD per job compared to coiled tubing.

3 Electricline Cleaner and Milller

3.1. Work Principal

Figure 8. Electricline miller
(Rahman, 2019)

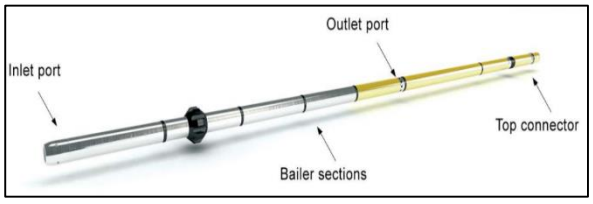
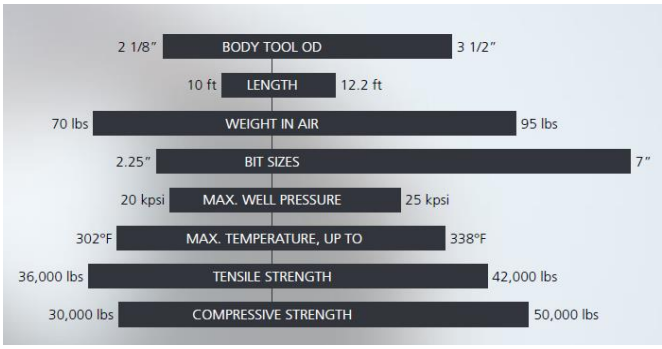


Figure 9. Electricline cleaner
(Rahman, 2019)

Operated using well intervention electricline unit. With the flexibility of the Bottom Hole Assembly (BHA) that is installed at the end of the wireline cable, making the electricline unit able to do various types of work



and the footprint of the unit and accessories is much smaller than the coiled tubing unit. The electricline miller will use specific mill bit BHA to mill the sediment until it can be bailed (See figure 8). This tool uses 2 basic principles related to the use of weight on bit (WOB) and anti-torque.

Figure 10. Electricline miller specification
(Rahman, 2018)

Figure 10 shows electricline cleaner miller specification. The operations continues using electricline cleaner consist of nozzle and bailer to take up and keep the sediment that has been milled. The sediment can be eliminated to open well accessibility to target depth. Both electricline cleaner and miller equipped with motor and hydraulic pump driven by electronic. Electricline cleaner consist bailer with 3.2 gallons maximum volume, can be operated in a well with pressure and temperature up to 25.000 psi and 302^0F.

3.2. Operations Result

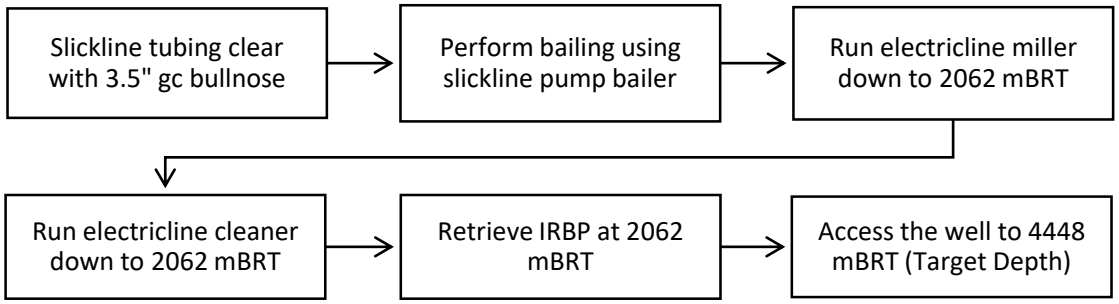


Figure 11. PK-Jx operations sequences

Running 3.5" GC bullnose to check tubing clear to TOS depth, confirmed TOS depth at 2030 mBRT. Pump bailer run using slickline in total recovered 15.2 liters combination of condensate, gel and soft sand in 15 runs for 2 days until 2035 mBRT. In the last 2 pump bailer running found nothing but still restricted. Decide to run electricline cleaner to recover sediment directly. In 2 run total recover 2 liters of gel and soft sand. Confirmed, hard sediment covering the well at 2036 mBRT. Decide to run electricline miller to crush the sediment. To prevent tool stuck by crushed sediment, combine electricline cleaner after 2 run of electricline miller with indication 5 meters accessed depth from latest top of sediment.

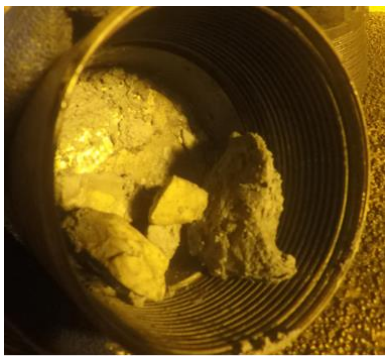


Figure 12. Sediment recovered

Figure 13. Sediment at electricline cleaner

Figure 12 shows recovered debris with electricline cleaner, 235.3 liters total cumulative sediment recovered in 29 run combination of miller and cleaner. Opening access to IRBP depth at 2062 mBRT validated with 3.5" GC bullnose run using slickline. IRBP can be retrieved successfully and continue check well accessibility to 4448 mBRT.

4 Conclusion

PK-Jx operation considered successful to open well accessibility and unlock 1.1 bcf potential gas stakes. Electricline cleaner and miller can mill out sediment from 2030-2062 mBRT with high success ratio to get 100% well accessibility for next intervention. This clean out technologies fits perfectly with common offshore minimalist platform and very suitable for marginal reserves with simple operation and lower operation cost compare with conventional method. Proven cost efficiencies up to 430 USD. For PT Pertamina Hulu Mahakam, this method also removing the mobilization fee due to utilization of barge unit existing electricline. Minimize heavy lifting risk in conventional method concern with fewer lift, fewer limits and fewer personel required. This is another milestone success story application of electricline cleaner and miller in operation in Pertamina Hulu Mahakam.

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Acknowledgments

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