



Sustainable Sand Management Control and Solutions - Balancing Performance, Costs, and Environment

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World's Longest Installation of 9-5/8" Advanced Multi-Zone Gravel Pack System for Six Zones in Offshore Malaysia

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Advanced Multi-Zone Gravel Pack System Background

- Field B typically having multi layered reservoirs with poor sand quality and high fines.
- Initial design was to complete 2 zones with C&P and 3 zones with gravel pack.
- Upon optimization, the GP zones increase to 6 zones.
- The total length of Sand Control assembly reached a staggering 1,091 m (3,579 ft).

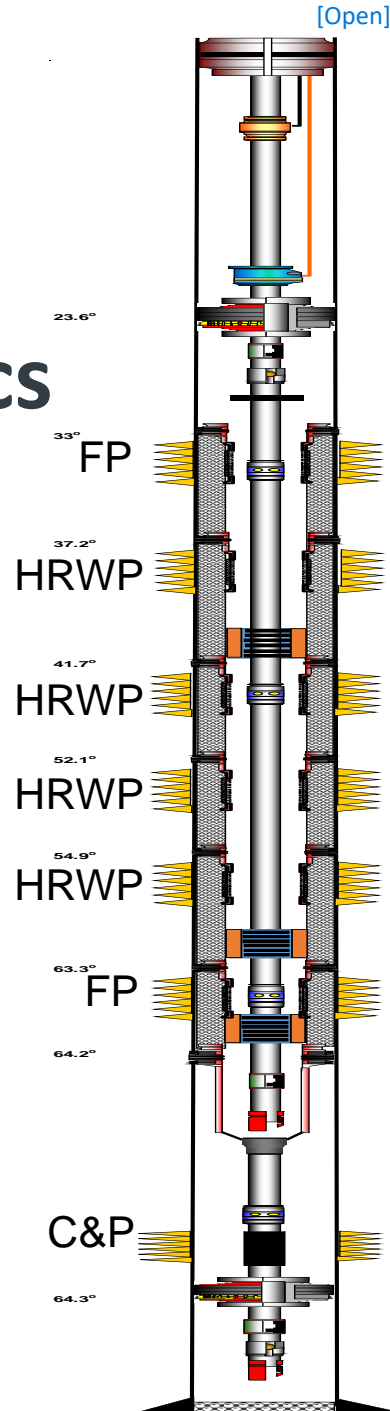
Advanced Multi-Zone GP System Challenges

- Long interval to ensure minimum trip of TCP and deburr run for C&P and multizone GP.
- Long 6 zones gross interval to be covered by multizone GP system.
- Additional 1 target to be completed with cased & perf.
- Multiple zones with high risk of tool stuck post GP.
- Single selective design for upper completion to manage productivity for all the zones.
- Multizone GP system space out due to multiple zone with different depth and to avoid water/coal contact.
- Inability to manipulate frac sleeve due to shallow depth (insufficient weight).

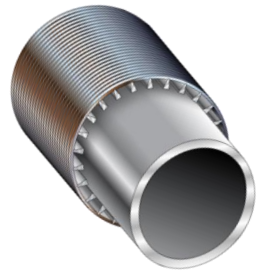
Advanced Multizone GP System Schematics

Unique Configuration of WP

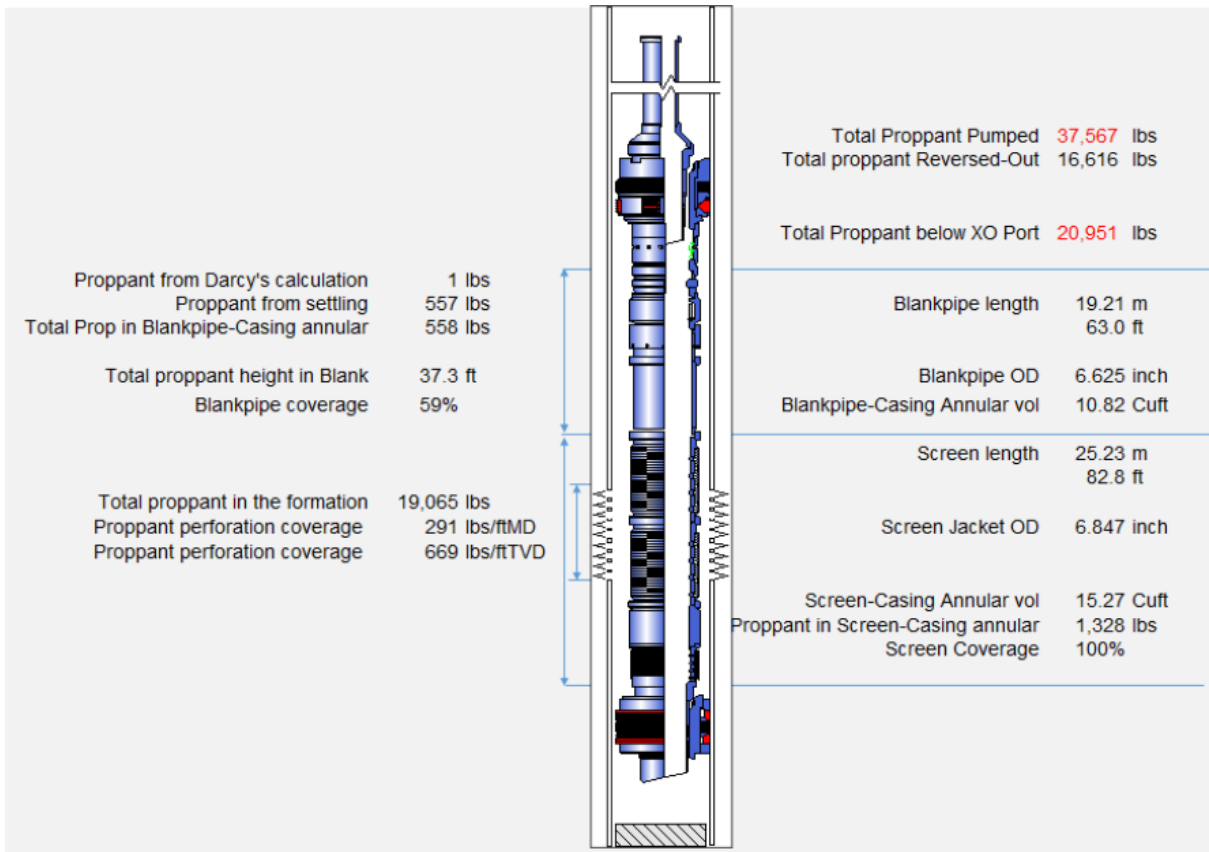
- Lower service tool 4" washpipes was re-configured (run shorter) to compensate the crossover's depth at tail pipe below GP Sump Packer.
- Frac sleeve re-manipulation and final pressure test to confirm system integrity after the suspension tool was retrieved.
- Additional WP trip with HWDP for top two zones.



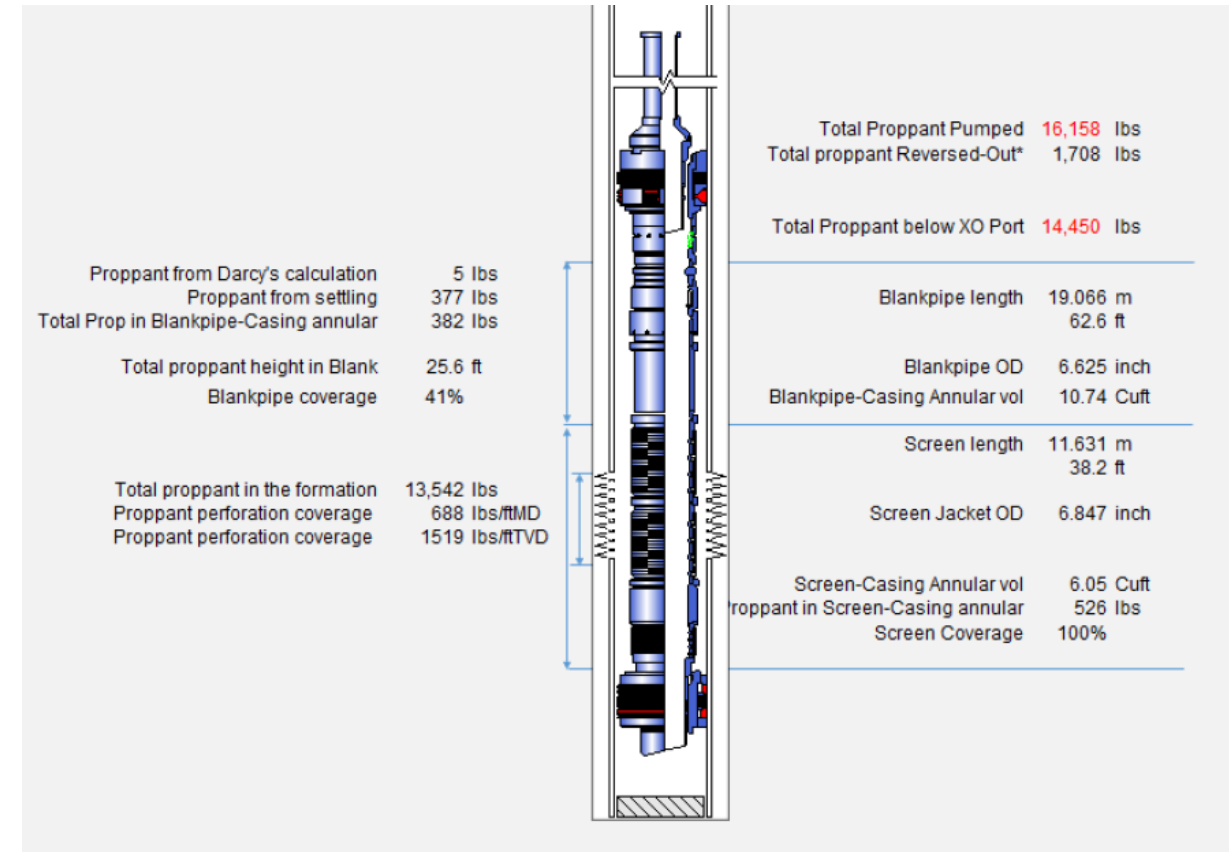
- Isolation packer
- Spacer pipe
- Gravel-pack assembly with hydraulically activated shear sub
- Blank pipe
- Conventional screen & modular screen (WWS) with non-perforated basepipe
- Mid-joint production sleeve
- Frac circulation sleeve
- GP Packer as sump packer



Advanced Multi-Zone Gravel Pack Pumping Result

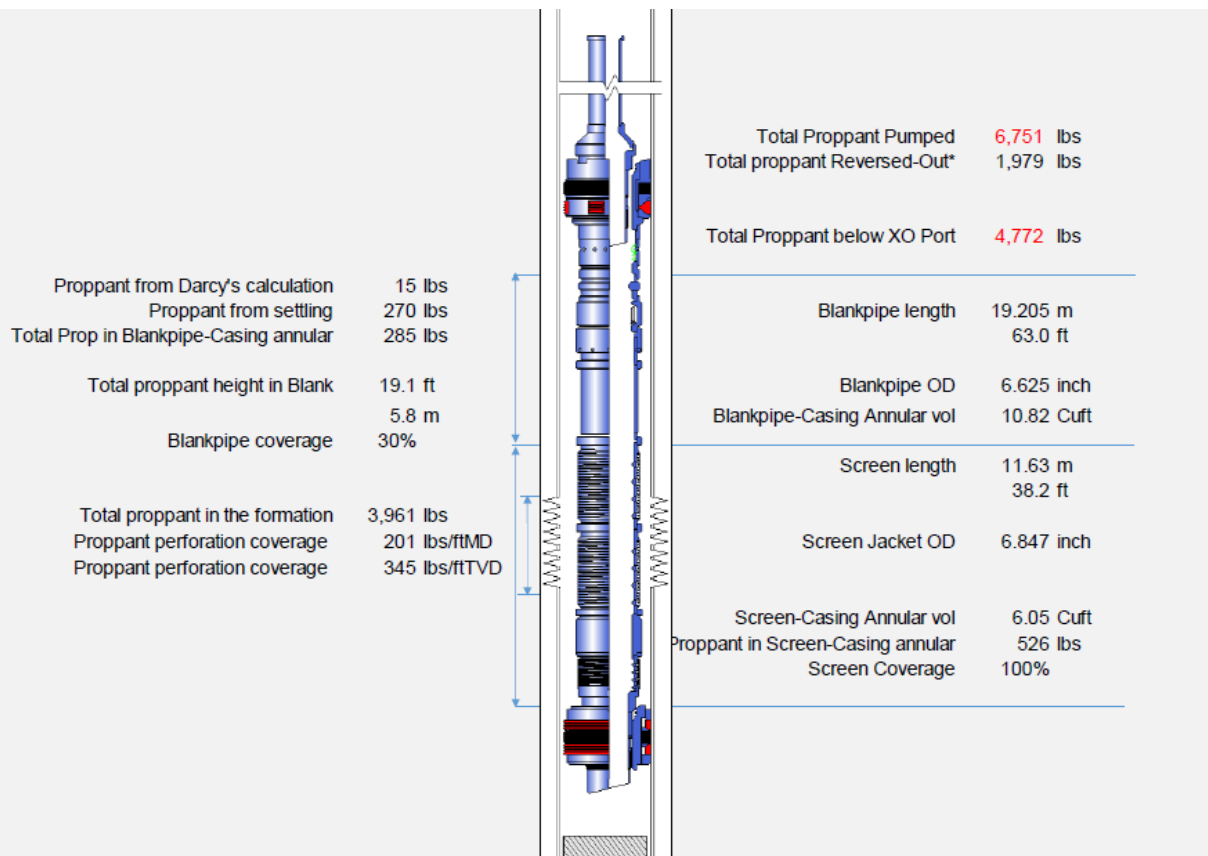


Zone 1 (Fracpack)

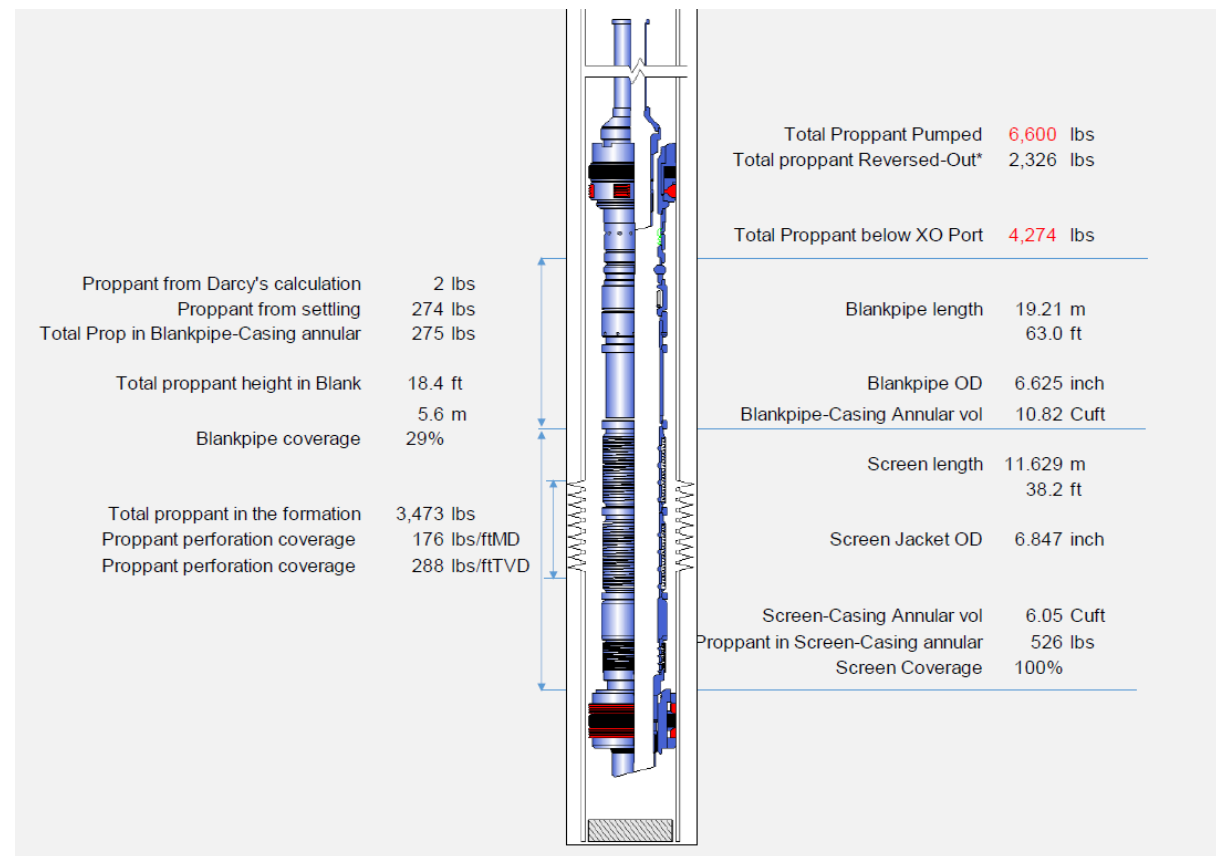


Zone 2 (HRWP)

Advanced Multi-Zone Gravel Pack Pumping Result

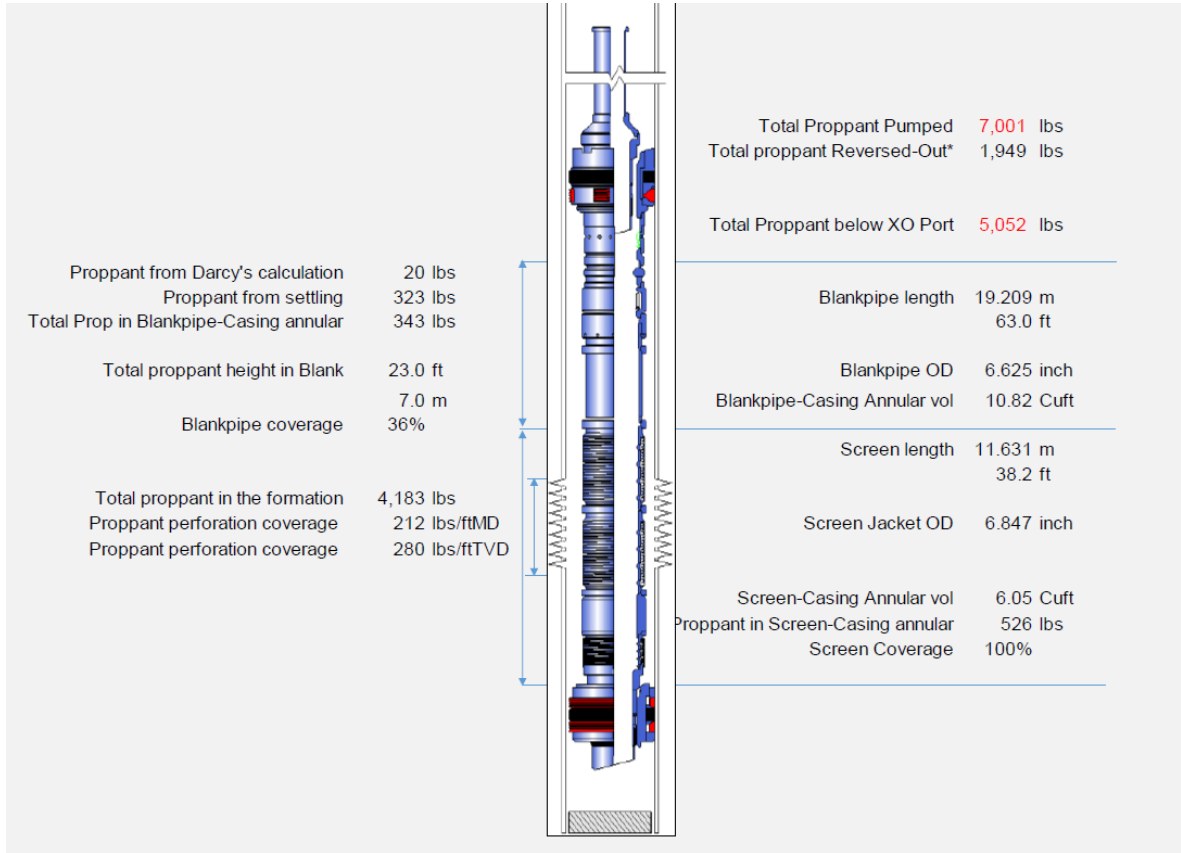


Zone 3 (HRWP)

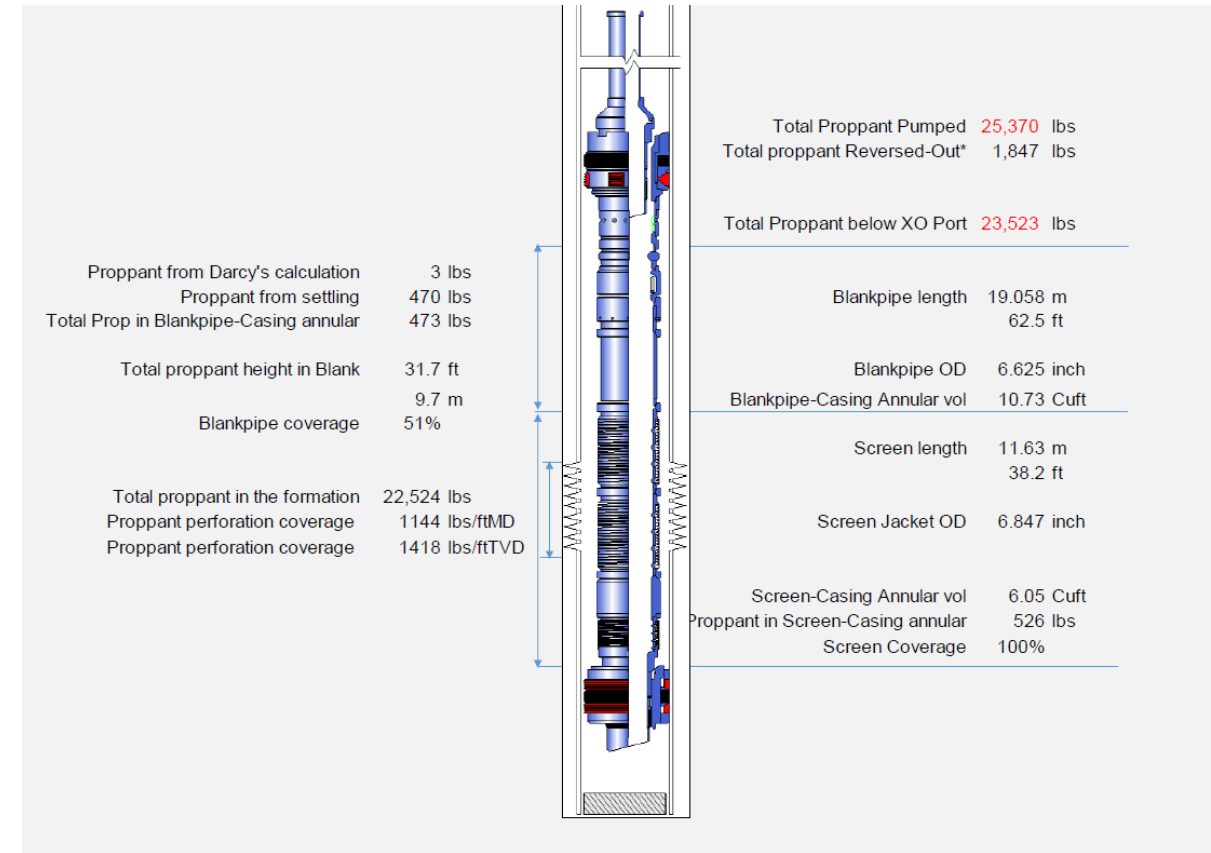


Zone 4 (HRWP)

Advanced Multi-Zone Gravel Pack Pumping Result



Zone 5 (HRWP)



Zone 6 (Fracpack)



Advanced Multi-Zone Gravel Pack System Lesson Learnt & Best Practices

Perforation

Accurate perforation depth & planning at design stage

- To ease equipment planning and space-out consideration

GP Multizone System

Thorough Torque & Drag and Tubing Movement Simulation

- To ensure sufficient weight were slack-down and eliminate any possibilities of seals movement during packer setting & pumping activities

Wellbore Clean Out

Thorough WBCO

- To ensure GP multizone system and service tools can be trip in and out without any hindrance

Pumping

On-fly mixing fluid system

- Provide flexibility to adjust fluid properties (viscosity) as required for the job type (ie: HRWP or FracPack)
- Eliminate the mixing time between zones

Extra fluid in the annulus

- Extend PAD stage to put ~30 bbl of gel in annulus
- Aid during reversing out, lifting slurry, especially in small annulus clearance of lower completion tool

Remote data transmission

- Live job monitoring
- Fast decision making

Acknowledgement

The team would like to extend their heartfelt appreciation to PETRONAS Carigali Sdn. Bhd. for allowing all the information to be used in this SPE Workshop. All the members who actively participated and made valuable contributions to the successful execution of this project, despite the challenging and high-risk nature of the operations. Their unwavering commitment to ensuring safety and compliance is commendable.

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