ABSTRAK

DESAIN LUMPUR PENGEBORAN BERDASARKAN ANALISIS XRD SAMPEL *CUTTING* DARI SUMUR DNL-26 LAPANGAN DNL

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Operasi pengeboran pada lintasan *intermediate section* di Lapangan DNL secara historis menembus formasi *shale* yang rentan memicu *wellbore instability*. Dengan memanfaatkan Sumur DNL-26 sebagai sumur representatif, permasalahan utama yang diangkat dalam studi ini adalah bagaimana merumuskan sistem fluida pengeboran yang secara spesifik mampu mengatasi karakteristik formasi di lapangan tersebut. Oleh karena itu, penelitian ini bertujuan untuk mendiagnosis karakteristik mineralogi batuan secara presisi, serta merancang dan memvalidasi efektivitas sistem *high-performance water-based mud* (HPWBM) untuk memitigasi komplikasi tersebut pada sumur-sumur pengembangan selanjutnya.

Metode yang digunakan mencakup karakterisasi sampel batuan melalui analisis *x-ray diffraction* (XRD) dan *methylene blue test* (MBT). Berdasarkan hasil diagnosis tersebut, dua jenis fluida diformulasikan untuk diuji secara komparatif, yaitu sistem KCl-Polimer dan sistem HPWBM. Kinerja kedua sistem dievaluasi untuk membandingkan efektivitasnya secara mikroskopis dan makroskopis dalam menekan laju hidrasi maupun disintegrasi batuan.

Sebagai upaya memitigasi reaktivitas formasi tanpa merusak stabilitas mineral kaolinit akibat paparan ion kalium yang berlebih, konsentrasi KCl dibatasi pada batas aman sebesar 3%. Guna mencapai daya inhibisi maksimum tanpa merusak integritas batuan, dirumuskanlah sistem *high-performance water-based mud* (HPWBM) melalui kombinasi sinergis 3% KCl dan 2% poliamin.

Kata Kunci: fluida pengeboran, *high-performance water-based mud*, kapasitas tukar kation, stabilitas lubang sumur, *x-ray diffraction*

ABSTRACT

DRILLING FLUID DESIGN BASED ON X-RAY DIFFRACTION (XRD) ANALYSIS OF CUTTING SAMPLES FROM WELL DNL-26, DNL FIELD

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Drilling operations in the intermediate section of the DNL Field have historically penetrated shale formations that are prone to triggering wellbore instability. By utilizing Well DNL-26 as a representative well, the main problem addressed in this study is how to formulate a drilling fluid system specifically capable of mitigating formation reactivity in the field. Therefore, this research aims to precisely diagnose the mineralogical characteristics of the rock, as well as to design and validate the effectiveness of a high-performance water-based mud (HPWBM) system to mitigate these complications in future development wells.

The methods employed include rock sample characterization through x-ray diffraction (XRD) analysis and methylene blue test (MBT) measurement. Based on the diagnostic results, two fluid systems were formulated for comparative testing a KCl-Polymer system and an HPWBM system. The performance of both systems was evaluated to compare their effectiveness, both microscopically and macroscopically, in suppressing the rate of hydration and rock disintegration.

In order to mitigate formation reactivity without compromising the structural stability of kaolinite minerals due to excessive potassium ion exposure, KCl concentration was restricted to a safe threshold of 3%. To achieve maximum inhibition capacity without damaging rock integrity, a high-performance water-based mud (HPWBM) system was formulated through a synergistic combination of 3% KCl and 2% polyamine.

Keywords**:** *cation exchange capacity, drilling fluid, high-performance water-based mud, wellbore stability, x-ray diffraction*