Pengaruh kecepatan pipa pengeboran terhadap karakteristik tekanan surge dan swab pada sumur pengeboran minyak dan gas bumi = The effects of drill pipe speed on characteristic of surge and swab pressure in oil and gas well drilling / Dwikana Fitra

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Abstrak

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Memprediksi besar tekanan surge dan swab sangat penting dalam proses pengeboran minyak dan gas bumi. Perhitungan tekanan surge dan swab yang akurat dapat memudahkan kita dalam merencanakan operasi pengeboran, khususnya pengeboran pada sumur yang membutuhkan safety yang tinggi, celah antara pipa pengeboran dan wellbore yang sempit dan pada sumur dengan kedalaman yang tinggi. Tekanan surge yang berlebihan dapat menyebabkan lost circulation dan retak formasi, sedangkan tekanan swab yang berlebihan dapat menyebabkan kick dan blowout, dimana untuk menyelesaikan permasalahan-permasalahan ini membutuhkan biaya yang sangat besar. Mengingat ribuan sumur dieksplorasi di tiap tahunnya, fenomena ini adalah hal penting bagi industri minyak dan gas bumi untuk meminimalisir biaya eksplorasi. Hasil studi teoritis dan lapangan telah menunjukan bahwa tekanan surge dan swab dipengaruhi oleh parameter-parameter seperti kecepatan pipa, geometri wellbore, faktor eksentrisitas, reologi fluida dan apakah pipa yang digunakan terbuka atau tertutup. Penelitian ini bertujuan untuk menganalisis besar karakteristik tekanan surge dan swab dalam skala laboratorium dengan variasi kecepatan pipa 0.08 m/s, 0.10 m/s, dan 0.12 m/s. Set-up alat terdiri dari ID 56 mm pipa akrilik dan OD 34 mm pipa besi yang dapat bergerak vertikal dengan menggunakan sistem angkat sederhana. Tekanan pada dinding sumur diukur menggunakan dua pressure transmitter dengan fluida pengeboran yang digunakan adalah air dan campuran 3500 ml air dan 150 gr bentonite. Dari hasil penelitian ini, kecepatan pipa pengeboran mempengaruhi besar tekanan surge dan swab. Kecepatan pipa terbesar 0.12 m/s menghasilkan gradien tekanan surge dan swab terbesar yaitu 0.0229 psi/ft dan 0.0256 psi/ft.
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ABSTRACT
Surge and swab pressure prediction is very important in drilling process during well construction operations. Accurately predicting surge and swab pressure model can ease on planning drilling operation, mainly in wells with high safety environment, low-clearance casings and deep water wells. Excessive surge pressure can lead to a number of costly drilling problems such as lost circulation and formation fracture, while excessive swab pressure can result in kicks, and blowouts. As thousands of wells are drilled every year, this phenomenon is of economic importance for the oil industry. Recent theoretical and field studies have indicated that surge and swab pressure depends on many parameters such as drill pipe movement speed, wellbore geometry, eccentricity factor, fluid rheology, and whether the pipe is open-ended or closed-ended. The study aimed at analyzing the effects of pipe movement speed on surge and swab pressures under laboratory conditions. Experimental study was performed in a test setup that can varying the drill pipe movement speed and measuring the surge and swab pressures. The setup consists of ID 56 mm fully transparent polycarbonate tubing and OD 34 mm inner steel pipe, which moves vertically using a simple

hoisting system. Pressure on the wall of the well was measured using two pressure transmitters at various drill pipe movement speed and drilling fluid in this experiments were conducted using water and water based mud which is 3500 ml water mixed with 150 gr bentonite. The experimental results showed that the speed of the drill string downward and upward affects surge and swab pressure. From the study, it was concluded that at the highest downward and upward speed of drill pipe, the surge and swab pressure increases respectively. Maximum speed of downward and upward drill pipe at 0.12 m/s results the highest surge pressure and swab pressure at 0.0229 psi/ft and 0.0256 psi/ft.