RINGKASAN

Sumur TR-003 dan NV-004 adalah dua sumur gas di lapangan Haradh, Ghawar Saudi Arabia yang dijadikan objek penelitian dalam tesis ini. Kedua sumur ini memiliki karakteristik formasi Khuff-C ketat *(tight)* dengan permabilitas porositas yang rendah dan tingkat *stress* batuan yang tinggi. Teknik perforasi konvensional telah terbukti menghasilkan kerusakan di area dekat lubang sumur yang tinggi sehingga teknik perforasi abrasif diperkenalkan sebagai alternatif teknik pelubangan perforasi pada formasi ini yang bertujuan untuk meminimalkan kerusakan di area dekat lubang sumur yang terjadi.

Penelitian ini bertujuan untuk membuktikan bahwa teknik perforasi abrasif akan menghasilkan kerusakan di area dekat lubang sumur yang lebih kecil daripada teknik perforasi konvensional. Metoda analisa dimulai dari pengumpulan data yang meliputi beberapa parameter yaitu profil sumur (tipe sumur, deviasi, dan lain-lain) dan karakteristik formasi (*stress* batuan, porositas permabilitas, *young modulus*, dan lain-lain) dan data *step down rate test. Screening* kandidat dilakukan untuk menentukan teknik pelubangan perforasi yang tepat berdasarkan parameter-parameter penelitian tesebut. Teknik perforasi konvensional dilakukan pada sumur TR-003 dan teknik perforasi abrasif dilakukan pada sumur NV-004. Injeksi fluida kemudian dilakukan setelah lubang perforasi terbentuk melalui proses *step down rate test* dan hasilnya dianalisa untuk mendapatkan nilai kerusakan di area dekat lubang sumur yang terjadi pada masing-masing lubang perforasi di kedua sumur.

Evaluasi penelitian menunjukkan nilai gesekan perforasi sebesar 1160 psi pada laju aliran 32.64 bpm dan 1381 psi pada laju aliran 37.9 bpm untuk sumur TR-003. Nilai gesekan perforasi sumur NV-004 sebesar 550 psi pada laju aliran 40.9 bpm dan 280 psi pada laju aliran 30.37 bpm. Nilai tortuositas sumur TR-003 sebesar 1221 psi pada laju aliran 37.9 bpm dan sumur NV-004 sebesar 1131 psi pada laju aliran 40.9 bpm. Perforasi abrasif menghasilkan lubang dan terowongan perforasi yang lebih bersih dari *debris cuttings*. Nilai *skin* sumur TR-003 sebesar 2.776 (positif) sedangkan sumur NV-004 sebesar -0.73 (negatif). Keseluruhan nilai perbandingan kerusakan di area dekat lubang sumur akibat kedua teknik perforasi menunjukkan bahwa teknik perforasi abrasif memiliki banyak keunggulan dibandingkan teknik perforasi konvensional dan sangat cocok untuk digunakan pada pada sumur gas horizontal di Lapangan Haradh Saudi Arabia.

Kata Kunci : Perforasi Abrasif, Tortuositas, Gesekan Perforasi

ABSTRACT

The TR-003 and NV-004 wells are two gas wells in the Haradh field, Ghawar Saudi Arabia which are the research objects in this thesis. These two wells have the characteristics of the tight Khuff-C formation with low porosity permability and high rock stress levels. Conventional perforation techniques have been proven to produce high levels of damage in the area near the wellbore, so the abrasive perforation technique was introduced as an alternative perforation technique in this formation which aims to minimize the damage that occurs in the area near the wellbore.

This research aims to prove that abrasive perforation techniques will produce less damage in the area near the wellbore than conventional perforation techniques. The analysis method starts from data collection which includes several parameters, namely well profile (well type, deviation, etc.) and formation characteristics (rock stress, permability porosity, young's modulus, etc.) and step down rate test data. Candidate screening is carried out to determine the appropriate perforation technique based on these research parameters. The conventional perforation technique was carried out on the TR-003 well and the abrasive perforation technique was carried out on the NV-004 well. Fluid injection was then carried out after the perforation hole was formed through a step down rate test process and the results were analyzed to obtain the damage value in the area near the wellbore that occurred in each perforation holes in both wells.

The research evaluation shows a perforation friction value of 1160 psi at a flow rate of 32.64 bpm and 1381 psi at a flow rate of 37.9 bpm for the TR-003 well. The perforation friction value for the NV-004 well is 550 psi at a flow rate of 40.9 bpm and 280 psi at a flow rate of 30.37 bpm. The tortuosity value of the TR-003 well is 1221 psi at a flow rate of 37.9 bpm and the NV-004 well is 1131 psi at a flow rate of 40.9 bpm. Abrasive perforation produces holes and perforation tunnels that are clearer from cuttings debris. The skin value of the TR-003 well is 2,776 (positive) while the NV-004 well is -0.73 (negative). The overall comparative value of near wellbore damage caused by the two perforation techniques shows that the abrasive perforation technique has many advantages over conventional perforation techniques and is very suitable for use in horizontal gas wells in the Haradh Field, Saudi Arabia.

Key Words : Abrasive Perforation, Tortuisity, Entry Friction