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Successful Water Shut Off in Extended Reach Horizontal Wells Using Inflatable Technology

Danny Alvarez, SPE, Occidental Qatar; Arend Snaas, SPE, Weatherford International.

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Abstract

The Idd El Sharji field in the Arabian Gulf is located offshore Qatar. It has been developed with many extended reach horizontal wells and pressure maintenance is achieved by an aggressive water injection program. In a recent remedial operation a total of three such wells were treated using coiled tubing (CT) conveyed inflatable equipment, two of them being water injection wells with thief zones which gave rise to inefficient sweep and low injection pressure and the third being a producing well with an unacceptably high water cut.

The remediation involved the use of inflatable bridge plugs and cement retainers with a cement squeeze being applied in between them and all three wells were successfully repaired and returned to operation. The treatment of the two injectors resulted in a marked increase in injection pressure indicating that the thief zone had been shut off and the treatment of the producer resulted in an increase in oil production of 4000Bbl/day at a greatly reduced water cut.

In this paper the authors will discuss the treatment program, which allowed the completion to remain in place and thus saved a costly workover operation. They will go on to discuss the operational details and review the lessons learned and the improvements indicated therein which can be applied to such operations in the future.

Introduction

The Id El Sharji North Dome field (ISND) was first developed with the installation of the PS-1 production station in 1963 in approximately 100ft of water off the North East coast of Qatar in the Arabian Gulf (see Fig. 1). In 2006 the average production from the field was some 104,000bopd from 81 wells producing from several distinct reservoirs, the Nahr Umr, Shuaiba, Kharaib, Arab C and D, the upper and lower Araej and the Uwainat. The lithology of the field varies from intermittent sands and shales, to sandstones and lenticular carbonates. Production from the Nahr Umr is by primary depletion drive while production from the other zones is supported by water injection programs of varying aggressiveness. Initial production was from vertical wells but as horizontal and extended reach technology developed so the newer wells took advantage of this.

The resultant extended reach wells are typically completed with 7” casing and a tubing string with a minimum restriction of 3.75” making access to the perforated areas of the well impossible with conventional mechanical equipment. Thus when an injection well starts to exhibit reduced injection pressure indicating a thief zone, or the water cut of a producing well increases rapidly indicating water breakthrough, remedial action can be done in one of two ways:

- By performing a workover to pull tubing and carry out remedial work, which is a costly operation.
- By using thru-tubing methods employing CT and inflatable pack off equipment.

With the large difference in operating costs between the two approaches being the driving force a remedial program was recently performed using the latter approach to treat three wells:

- Well # IS-205, an injection well with a thief zone taking most of the water resulting in a reduced injection pressure and consequent degradation in the sweep pattern.
- Well # IS-214 a producing well with water breakthrough causing excessive water cut.
- Well # IS-15A another injection well with a thief zone.

Operation

In order to treat these three wells it was decided to utilize coiled tubing to deploy an inflatable retrievable bridge plug (IRBP) below the thief zone (or above the water producing perforations in the producing well), followed by an inflatable cement