

A Case Study on the Impact on Field Performance Due to Reduced Annulus Pressure in a Steam Flooded Heavy Oil Reservoir

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Abstract

It has been observed that wells producing from a heavy oil-field where steam is being injected exhibit a large annulus pressure. Values of up to 15 bar have been measured at the casing head. It is possible to bleed the annulus into the production flowline. However, wells which are furthest away from the production separator are producing against a higher flowline pressure. Therefore, the annulus cannot be bled into the flowline directly. Due to the well design, this annulus pressure is exerted onto the production interval and forms a component of the total back-pressure in a production well. One of the consequences is the need to maintain a higher injection pressure in order to overcome the back-pressure. This reduces the energy efficiency of the production system.

A small-scale project was carried out on a specimen well where large values of annulus pressure were seen. The project involved the installation of a beam gas compressor at the well head which would bleed the annulus down to approximately 1 bara and send the compressed gas into the production flowline. The results showed an improvement in the production performance of the well.

The promising results from the project set in motion a study into the potential benefits of reducing the annulus pressure of multiple wells producing from a larger section of the oil-field. The production wells furthest away from the production separator were considered. The study comprised of investigating different methods by which annulus pressure could be reduced. These included;

- Increasing the flowline diameter which would reduce the flowline pressure and hence ease the bleeding down of the annulus of wells
- Installing a multiphase pump within the flowline to reduce the upstream flowline pressure
- Installing multiple beam gas compressors

The reduction in the annulus pressure of the target wells from all three methods were calculated and then incorporated into dynamic reservoir simulation. The multiple beam gas compressor option seemed to be the most effective in terms of pressure reduction and field implementation. The results suggested an approximate gain of 10% in oil volumes over 20 years.