

#### **Claim 4 Develop safe and sustainable solutions**

Upon taking the petroleum and reservoir engineering responsibilities for a CSG field in Queensland, it was evident that the majority of my time was involved in workovers to repair downhole pumps. These repairs were made complicated by the pumps becoming stuck downhole. The operation to release the pumps was complicated and required close supervision to maintain safety. The goal was to minimise downhole pumps getting stuck and improve their run lives. A successful outcome would enable more staff time allocated to production optimisation.

I initiated a review of the wellbore construction. This involved reviewing past operations and interviewing field operators and rig supervisors. Interviewing the field staff generated very helpful ideas and solutions. They were continually consulted throughout the process and their input was invaluable. The process also improved communication between the field and office personnel.

A historical review of all the workovers and pump performance was undertaken. These vertical wells were fracture stimulated and produced significant frac sand during the initial years of production. The downhole pump was often damaged by sand which lodged between the pump and well casing. To free the pump, the work-over rig would endeavour to pull free the completion string. This operation required stringent safety management and was very time consuming. If this operation was unsuccessful, the workover rig would run a macaroni sting down the annulus and, using air, dislodge the debris around the pump. The operation was complicated and, if done incorrectly, could render the well unusable.

Review of pump performance indicated failures were independent on manufacturer and primarily due to external causes. The configuration of the downhole completion focused on areas susceptible to sand and debris lodgement. Tubing collars were chamfered. A discussion with pump suppliers proposed a trial of slim-hole pumps. If unavailable, the large diameter pump had to be positioned in the completion string to minimise getting stuck and gas entering the pump inlet. Analysis of the workover history generated a sand production profile enabling the optimisation of the rat-hole configuration. This minimised the chance of the pump getting stuck and arranged for the workover rig to be able to retrieve the completion with ease if the lower section of the completion was buried. The downhole pumps often failed during the commissioning stage. An onsite review identified that an operation measurement anomaly [annulus fluid level] had occurred when gas production initially gained momentum. A sonic device [sonolog] was used to estimate the fluid level above the pump. When gas production commenced, water hold-up occurred in the annulus. This measurement can deceive the operator into setting incorrect pump parameters. Operational guidelines were modified and a procedure was developed to prevent erroneous readings.

Implementation of completion design configuration improved pump lives on existing wells. The rat-hole design on future wells was proposed as a trial for the next development program. This additional cost to the new wells was justified on the basis of lower maintenance costs. This reduced the number of workovers and operational time thus improving the overall safety of the project. The sustainability of this work was reflected in lower subsequent maintenance budgets.