Well Intervention and Workover: Operational Philosophy

You are the proud owner of a drilled, completed and on production oil and gas well. Production is coming in checks are being cashed and all is right in the world. Or is it? Is your well doing it's best? Will it suddenly quit producing in 6 months? Will the well present odd problems late in life? Can you predict what they will be? When should you recomplete to a new zone or conduct a P&A? what decisions should be made about the process? What dangers must be looked for? All these questions and worries are a part of the arena of workover and intervention. This is the first in a two-part series about well interventions and workovers. This first part will look mostly at the ideas behind the decision-making processes, and the second part will look at some case studies and examples which illustrate them.

What is an Intervention For?

The easy definition for what an intervention consists of is putting something in the well to make a change, other than making new hole. Usually this is a workover rig, snubbing unit, coiled tubing unit, slickline, or e-line. Pumping jobs where only fluids are introduced to the wellbore are a gray area. In some cases, they are routine maintenance events (hot oil to remove paraffin, regular injection tests, etc. and in others they represent a major change to the wellbore that requires careful study. The 'obvious' reason for doing an intervention is to get more production. This is often true, but interventions are done for lots of other reasons as well, such as:

- Gathering information about the wellbore or the formation
- Increasing oil production (the obvious one)
- Reducing water or gas production
- Increasing run time or reliability of wellbore components
- Replacing failed wellbore components
- Installing or changing artificial lift
- Providing fuel gas or gaslift gas for field operations
- Providing or improving water disposal
- Meeting pipeline volume or quality obligations
- Holding leases by production
- Production testing new zones
- Regulatory requirements
- Well barrier integrity testing or restoration
- Fishing and wellbore obstruction removal
- Sand control possibly even if it decreases well production
- Conversion to injection from production or vice versa
- reducing slugging or other undesirable behavior in surface equipment
- pad or slot reuse/recovery offshore, or on land where limited disturbance is desired or required.

Decision Factors: Economic Limitations

In most cases, the potential for gain is restricted compared with a drilling project, and this means that the budget to accomplish the project are similarly restricted. In most situations there is a trade off between effective techniques, and frugal ones. Which techniques to use depend on the expected payoff, and to some extent the risk of failing to succeed or having partial or short-term success. Sand control is a good example of this. In a high productivity well with large proven reserves, remedial sand control may consist of pulling the production tubing, running hundreds of feet of premium screens, and pumping a multi-million-dollar frac pack. On the other end of the spectrum, would be a low productivity stripper well, where remedial sand control might consist of setting a prepacked screen in tubing on slickline, or running a premium sucker rod pump which has longer run times to failure when pumping sand to surface than ordinary ones. In between are through tubing resin packs, circulating gravel packs, or squeeze packs. Selecting a 'premium' solution for a well without the productivity to support it will never result in a good economic outcome. Likewise, selecting a budget solution for a well with high potential productivity will result in rapid failure of the installation, reduced production, and lost reserves if yet another workover is not scheduled to repair the first one.

Decision factors: Uncertainty

Developing a procedure for a workover depends in large part on diagnosing exactly what is going on with the well in the first place. Sometimes this seems amazingly simple, but sometimes it is much more confusing. For wells which recently went off production, there is often ample information about their condition before the problem took place. For wells which have been off production for an extended period, or where the field/area has relatively little production history, the situation might be quite different. Another difficulty is that sometimes different root problems seem to present symptoms on the surface.

For example, if water cut has increased, is that a result of the formation watering out, or of a casing leak uphole across a water bearing permeable zone? Or is it a breakdown of the cement job allowing crossflow behind pipe? Or of water coning into the well due to local effects but not a general watering out? Or a result of some interaction with another nearby well in the reservoir? Or is a result of drawdown changes? Gathering information about the problem is critical to coming up with the right approach. There are times when gathering information becomes a daunting challenge in and of itself. There are other times when starting work with limited information is preferable to gathering the best possible information first. Gathering information and formulating a plan to use it takes time, money, and effort. Sometimes that effort, time and money is better spent doing something to find out what is wrong instead of studying the problem.

Compared with newly drilled wells (except wildcats, re-entry usually carries with it a greater range of potential risk factors. The risks themselves may or may not be larger, but the sources of risk are usually more numerous. For example: Have components in the wellbore failed due to age or exposure? Has the formation recharged or is it further depleted than originally expected? Has the cement job broken down? Are the records on the well any good? Is there anyone around who has first-hand knowledge of the last time anything was done to the well?

Irreversible Decisions

Some decisions made are effectively irreversible. You could sidetrack the well or drill a new one but from an economic POV, it's effectively irreversible in most cases, and the new drill or sidetrack is a whole separate project. Every irreversible decision is made before the full consequences are known, but there is no option. Imperfect information and unexpected results are part of the process when dealing with the downhole environment. Next article we will look at how these factors all interplay in three very different scenarios: A shallow vertical well on a rod pump in California that is producing poorly, a directional gravel packed gas well on the shelf of the Gulf of Mexico with a variety of recompletion opportunities , and a high rate deepwater well critical for the operation of a high productivity field.