

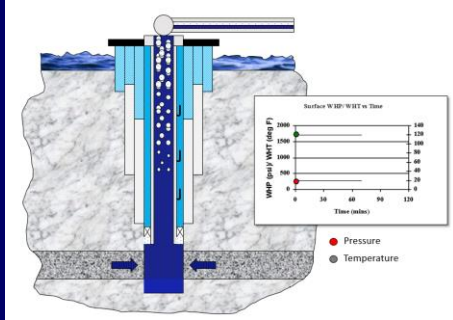


Figure: Steady state well condition

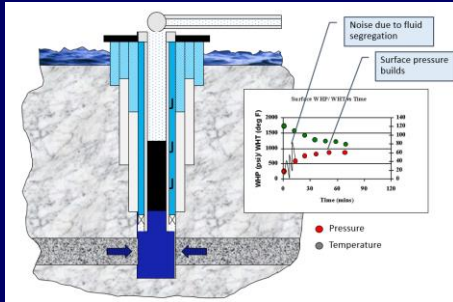


Figure: Shut in condition

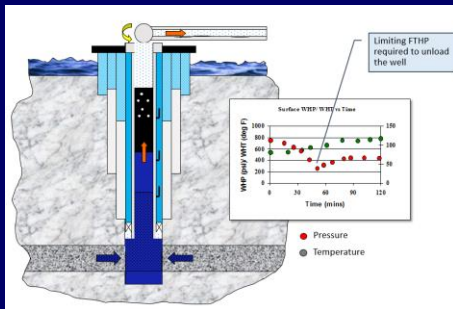


Figure: Start-up condition

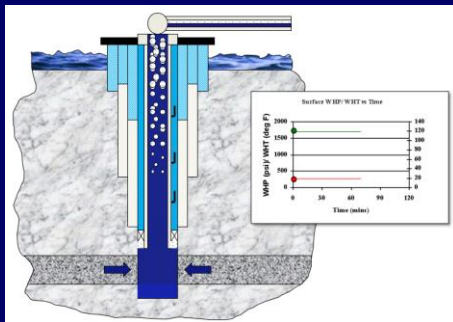
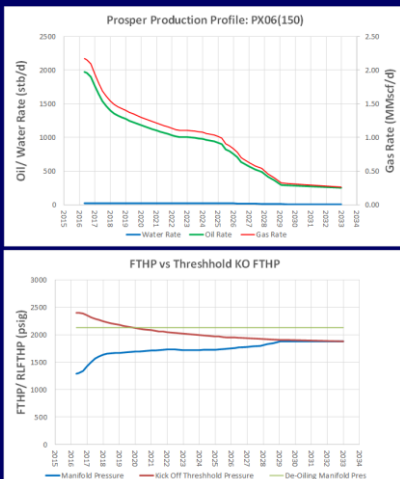


Figure: Back to steady state condition



TRINN WELL TRANSIENT SIMULATOR

OBJECTIVES

Sapella have actively been involved in building this transient and steady state simulator. Determining transient flowing conditions is essential for some design applications. They may assist in many applications such as:

- Computing and monitoring bottom hole pressures and PIs in wells more accurately from shut-in and steady state flowing calculations.
- In wells without bottomhole gauges, the tool computes downhole PTA data for PI, Pres and skin evaluation.
- Determining when wells become lazy and artificial lift is required.
- Designing gas lift or dual bore gas lift applications taking into account tubing start up conditions, thus determining unloading valve sequences more accurately.
- Establishing the maximum head encountered during start-up of jet pumps, gas lift or ESPs.
- Establishing optimal unloading quantifies of diesel and nitrogen required, to start up oil wells (for instance after work-overs with brine in the well).
- Calculating the maximum wellhead pressures encountered during field life.

DESCRIPTION

The simulator computes the steady state condition with a matched Prosper file or the Sapella multiphase flow module.

Shut-in

Next, the App computes the shut-in condition of the well. Three shut-in models have been defined by Sapella, which can be selected depending on the required detail and problem given. Model 1 – Final segregated state Requires 2 pressure points to ensure liquid and gas pressure gradients intercept at actual depth. This is used in wells that have WHPs and bottomhole DHGPs.

DESCRIPTION CONTD.

Final segregated gas, oil and water profile is established.

Model 2 – Final segregated state Requires steady state condition before the well is shut and no knowledge of downhole pressure. Calculates influx during shut in and completes a mass balance on fluids for final state. Final segregated gas, oil and water profile is established.

Model 3 – Segregation over time Requires steady state condition before the well is shut and no knowledge of downhole pressure. Calculates influx and segregation of gas/oil and water at every time step during shut in until all fluids are segregated. As this model requires a long computational time, it is only required for very detailed analysis.

Start-up

The model then completes start-up calculations taking following mechanisms into account: transient inflow behaviour, decompression of the fluids as the wellhead pressure decreases, mixing of fluids as gas enters the wellbore, other multiphase flow regimes not currently part of most common hydraulic models. This is particularly useful in understanding well start-up behaviour and identifying mechanical problems (such as the lazy well phenomena, gas lift valve unloading problems or estimating tubing leak depths).

WHAT IS UNIQUE

Easy to use

The simulator allows to compute life of well conditions, which may be of importance to determine when a well cannot kick off anymore. It can be used to identify artificial lift problems.

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