The Oilfield Jumble

Volume 1 – Brief introduction of the Oil Industry

The oil industry is usually divided into three major components:

- Upstream sector includes searching for and all subsequent works to bring crude oil or gas from underground to the surface.
- The midstream sector involves the transportation, storage, and wholesale marketing of crude or refined petroleum products.
- The downstream sector is the refining of petroleum crude oil and the processing and purifying of raw natural gas, as well as the marketing and distribution of products derived from crude oil and natural gas.

Oil and Gas E&P (Exploration and Production) are upstream company. They explore and recover oil and gas to surface, and sell them to downstream company.

Integrated Oil and Gas companies are usually larger and do everything from upstream to downstream. For example, Petronas is an integrated Oil and Gas company.

Exploration and production of oil and gas require lots of complex, specialized machineries and workers. Oil companies usually hire services companies to perform all the necessary steps in the exploration and production phase. Halliburton and Schlumberger are two of the many oilfield services company.

Seismic Survey

The Exploration and Production cycle starts with identifying potential oilfield by performing the seismic survey. Based on this seismic map, oil company will determine where they would drill one or several exploration wells.

The first exploration well is usually drilled vertically. The drilling rig normally belongs to the drilling company. PVD (PetroVietnam Drilling) is such a company.

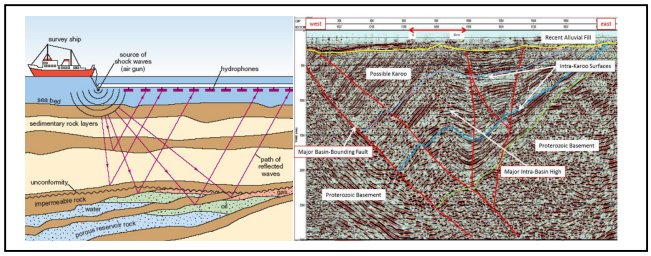

Figure 1 Seismic survey and map

Drilling a well

The well is drilled in sections. Lower section will have smaller diameter than upper section. Well diameter usually measured in inches, and can vary from 6” to 30”, depending on the depth of the well. Well’s depth and diameter normally determined during the well planning phase with the drilling plan. Oil well depth can vary from several hundreds of meters to thousands of meters.

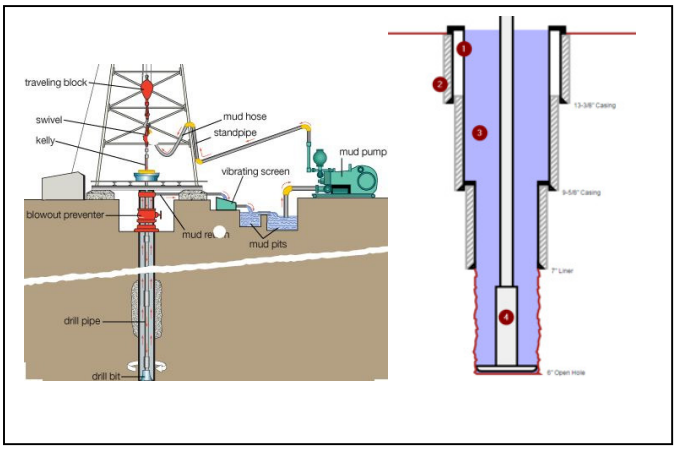

Figure 2 Drilling and Casing setting

Drilling Fluid

Drilling fluid is mixture of water (or oil) and specialized chemicals that get pumped into the well during the drilling process to maintain the pressure in the well, protect the drilling string and easing the drilling, as well as bringing the cutting (loose sand and rock from the drilling action) back to surface.

Well Logging

Drilling the well alone won't tell us whether the well would produce oil or not. Well logging is the action of lowering remote controlled sensors into the well to acquire necessary information about the rocks to better understand the oil and gas potential of the well. Well logging can be done while drilling (Logging While Drilling), or by Wireline; running logging equipment via electrical cable.

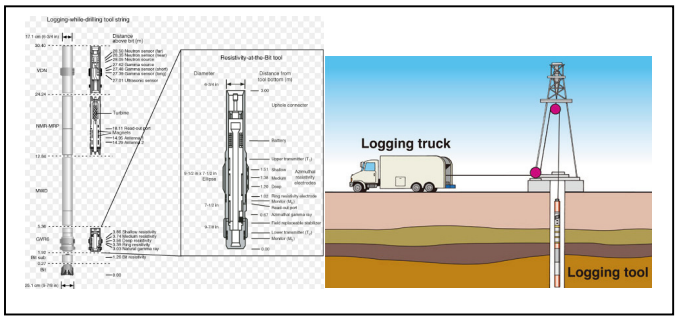

Figure 3 Logging while Drilling and Wireline

Casing and Cementing

After each drilling section, the well is "cased". Casing are steel tube with the outer diameter slightly smaller than the diameter of the well at that section. Once the casing is run to the bottom of the well, cement is pumped into the well, and overflowed to fill the "annulus"; the gap between the outside of the casing and the well. The cement is to protect and secure the casing in place, as well as providing the hydraulic lock between different sections of the well.

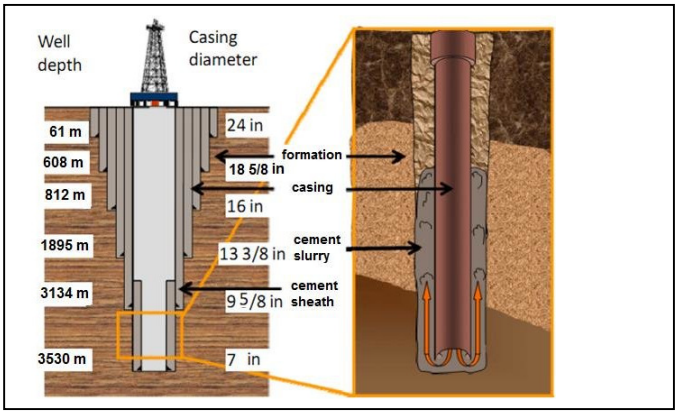

Figure 5 Casing and Cementing

Well Testing

Once the well has been drilled to the required depth, logged, casing is set and cemented, it is necessary to perform well testing to further confirming the economic feasibility of the well.

The well testing starts with well perforation; making hole on the casing to allow well fluid entry. Perforating gun are steel tube containing explosive shape charge, generating high pressure and temperature at time of detonation to punch the casing and the well's rock, allowing any fluid in the rock to enter the casing, where they will be brought to surface for testing. Information obtained during well testing include down-hole pressure, water, oil and gas properties etc… and are vital to the understanding of the long term economic value of the well.

Plug and Abandonment

The well is then closed off by permanent plugs and cemented to protect the well and prevent fluid leakage into surrounding environment. Depending on the result of the well's evaluation, this well maybe revisited in the future, or simply be left abandon without any further work done.

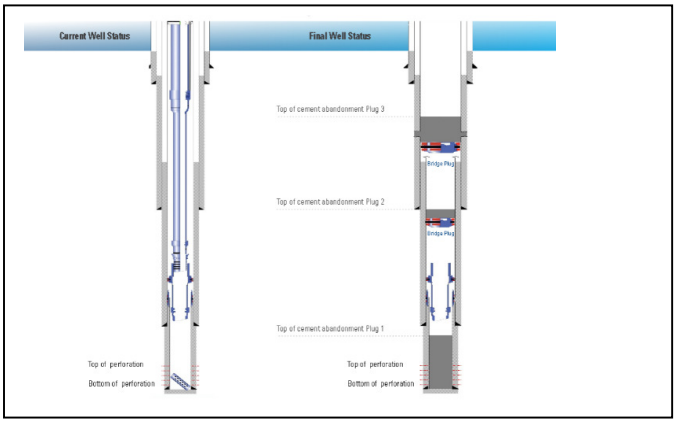

Figure 4 Plug and Abandonment

The above lists the common steps taken to drill and evaluate an exploration well. After a good exploration well, oil companies usually drill a few more "appraisal" wells to evaluate the field. Appraisal wells are often not drilled vertically, but with the few degrees offset from vertical, called "deviated wells".

The exploration step of the E&P cycle in an oil field is considered done after drilling and evaluation an exploration well and several appraisal wells. The oil company would then use the time to study and making the plan to develop the field, with the "Field Development Plan". That is the next step in the E&P cycle, and is the subject for later volumes.