Geophysical Research Abstracts
Vol. 12, EGU2010-2882-1, 2010
EGU General Assembly 2010

Measuring formation properties through well casing with pulsed neutron instrumentation

Darryl Trcka
Senior Research Scientist, Weatherford International (darryl.trcka@weatherford.com)

Measuring formation properties through well casing with pulsed neutron instrumentation

In the process of developing an oil or gas reservoir, the exploration team first confirms the existence of a potential reservoir with a discovery well. Then the size, content, and character of the reservoir are mapped with roughly six to twelve delineation wells. From this information the development team plans a development program to produce the oil and gas, which can run into hundreds of wells. Whereas the exploration and delineation wellbores are left open to the formation to allow measurement of the reservoir properties, the development wellbores are cased with cemented-in-place steel casing to isolate zones and allow targeting of specific oil or gas layers for production (which is accomplished by perforating the casing in the target zones with explosive charges). Once the casing is in place it obviously becomes more difficult to measure reservoir and formation properties since one-quarter to one-half inch of steel casing plus another inch or so of cement between the formation and the borehole greatly restrict the measurement methods that can be used. But there are over a million cased wellbores penetrating the earth's crust, many plugged, cemented, and abandoned, but many still producing oil and gas or otherwise available for logging. However difficult it may be, formation measurements through the steel casing are of importance to oil and gas production companies, and they could be of some value to earth scientists.
Since 1964 when the first instrument was introduced, pulsed neutron instrumentation for oil and gas well logging has been used to measure formation properties through casing. The basic downhole instrumentation consists of a pulsed fusion reactor for a source of high energy neutrons and gamma ray detectors for gamma ray spectroscopy. The early generation instruments measured water and oil proportions crudely and only in reservoirs where the connate water was highly saline. Subsequent generations expanded the utility of the measurements, and the latest generation is able to make precise and accurate measurements of a number of formation properties through casing. This presentation reviews the state of the art in downhole pulsed neutron logging in cased wellbores and presents an overview of some of the current capabilities and limitations. The presentation is not focused on a single design or company technology. Rather, it reviews features of the technologies available from major worldwide suppliers along with a discussion of the range of applications, accuracy and precision, best practices, and recommendations for logging program planning. Measurements discussed include formation mineralogy, porosity, and density; multi-phase oil, water, gas, condensate, and CO2 proportions in the pore space; pressure; and mechanical rock properties.