New investigations in former hydrocarbon exploration wells in the Aquitaine Basin, France: how to get reliable data? A case study.

Frédérick Gal, Jérôme Barrière, Gaëtan Bentivegna, Mohamed Djemil, Laurent André, Arnaud Wuilleumier

Geophysical Research Abstracts
Vol. 20, EGU2018-7172, 2018
EGU General Assembly 2018

New investigations in former hydrocarbon exploration wells in the Aquitaine Basin, France: how to get reliable data? A case study.

Frédérick Gal (1), Jérôme Barrière (2), Gaëtan Bentivegna (1), Mohamed Djemil (3), Laurent André (1), and Arnaud Wuilleumier (2)

(1) BRGM, Orléans, France (f.gal@brgm.fr), (2) BRGM, Pessac, France, (3) BRGM, Ramonville-Saint-Agne, France

In South-West France, deep aquifers lying in the Aquitaine Basin are often crosscut by exploration wells drilled for hydrocarbon exploration (borehole depths: up to more than 4000 m). Among the boreholes which did not show valuable traces of hydrocarbons, some have been plugged to a certain depth and abandoned. Their casings were perforated over a ten of meters above cement plugs, enabling hydraulic communication with an aquifer and allowing conversion into piezometers.

The Infra-Molassic Sands Aquifer is one of the aquifers to which such deep boreholes give access. This Eocene aquifer is of great interest because it has multiple uses, including drinking water, irrigation, geothermal applications and seasonal gas storage (André et al., 2002, C.R. Geoscience 334, 749-756). The uses depend on the location in the basin (120 km NS by 200 km EW) and the depth of the piezometric level (from less than 40 m to more than 200 m below ground level).

We present investigations recently performed (2017) in three of these boreholes. Two of them (Saint-André, Lacquy) are perforated around 440 m depth and the third (Polastron) is perforated around 820 m depth. In order to avoid the draw of several tens of m^3 of water to get representative samples – the purge of three times the water volume at Polastron would induce the pumping of 54 m^3 of water – we use the deep sampling technique with a system based on ball-check valves and neutral gas pressuring (patent FR1259214). In order to locate the levels of interest for sampling, geochemical logging, flow-meter measurements and borehole camera inspection have been performed prior to sampler lowering, allowing determining the casing condition and the structure of the water column under ambient flow conditions. A first deep sampling session (several depths investigated) has been performed under ambient conditions. A little stimulation by pumping has been realized afterwards, followed by a second deep sampling session. The pumping is intended to renew the water at the perforated levels. The measurement of the piezometric level before and after pumping confirmed groundwater flow from the aquifer to the borehole. In case the borehole was partially plugged (Saint-André) or presented floating hydrocarbon phases (Lacquy), the deep sampling has only been done after purging.

The data acquired at the deepest borehole (Polastron) showed minor changes on physico-chemical parameters prior to and after purging and highlighted that the producing levels were rather at the top of the perforations. Electrical conductivity and pH changes were always lesser than 3.5% (and often lesser than 1.5%) when comparing pre-pumping and post-pumping data thus indicating that, when care is taken to characterize the water column prior to sampling, deep sampling tools may give reliable results without the need of purging when perforations are located in front of productive levels. If extra-care is desired then the draw of a volume of water corresponding to that of the “screened” section can be done but this may, under certain circumstances, favor in-borehole vertical gradients e.g. by reinforcing thermal effect (Dumble, 2006, IAH 26th Groundwater Conference).