EGU21-10856
https://doi.org/10.5194/egusphere-egu21-10856
EGU General Assembly 2021

Evaluating the well integrity of old exploration wells as a risk factor for future storage projects – an example from the Troll field in the Norwegian North Sea

Bastien Dupuy[1], Benjamin Emmel[1], and Simone Zonetti[2]
[1]SINTEF Industry, Applied Geoscience, Norway (bastien.dupuy@sintef.no)
[2]SINTEF Digital, Smart Sensors Systems, Norway

More than 750 wildcat wells have been drilled in the Norwegian North Sea since 1966. Some of these wells could pose a risk for the environment, climate, and future H_2 and CO_2 storage projects by being preferred leakage paths for subsurface- and stored- gases (e.g., CH_4, CO_2 and/or H_2). To ensure well integrity, these wells were secured by cement framing the well casing, and by building cement plugs at crucial positions in the well path before abandoning the well. However, in an early stage of exploration the geology of the subsurface was relatively uncertain, and the requirements for plug placing and how to abandon a well were not established and regulated. We analysed data relevant for the quality of a Plugging and Abandonment (P&A) work done on old exploration wells (1979 to 2003) from the Troll gas and oil field in the Norwegian North Sea. The data were extracted from public available well completion reports and the webpage of the Norwegian Petroleum Directorate. The dataset was analysed regarding their availability, plausibility and evaluated towards the present P&A regulations and geological knowledge for offshore Norway. Based on 12 criteria including reporting to the authorities, volumetric assessment of used cement quantities, position and length of the plugs in relation to reservoir- cap-rocks petrophysical conditions, and verification of the cementing job, a final P&A ranking of 31 exploration wells was established.

Parts of this data were used to build realistic numerical models of P&A'ed well to simulate electromagnetic responses using the finite element software COMSOL Multiphysics. Taking advantage of a dedicated implementation of low frequency ElectroMagnetics (EM), including effective formulations for thin electrical layers, it was possible to study the response of well components to external EM fields, both for the purpose of well detection and well monitoring. Results from the numerical models can be used as benchmark models in a realistic field scale well integrity monitoring approach.

In our presentation we will show results from the TOPHOLE project including realistic field distributions for different representative well configurations, examples of well detection and monitoring signals, and the ranking evaluation results.

Acknowledgments: This work is performed with support from the Research Council of Norway (TOPHOLE project Petromaks2-KPN 295132) and the NCCS Centre (NFR project number

257579/E20).