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Role of the pore pressure profile on the protection of wellbore integrity and the groundwater: Case studies of well integrity issues of CI-11, in southern Tunisia, and OKN-32 in Algeria.

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The fluid's pore pressure represents the main geomechanics parameter to consider while planning for drilling operations and during production. Actually, a good understanding of overpressure origins leads to better characterize of the pore pressure, which materialized by the suggestion of several models to predict pore pressure. Therefore, the successful technical achievement of a drilling program is judged by the sustainable integrity of the well i.e. sealing effectiveness between different reservoirs. As a result, this should guarantee long-term water resources protection, rational production, and sustainable development.

The studied cases (CI-11 and OKN-32 wells) reflect the direct effect of the integrity failure of the cased hole, leading to the groundwater and ecological safety of the major transboundary aquifers system in North Africa. This aquifer is known as the North-Western Sahara Aquifer System (NWSAS), which is shared between Tunisia, Algeria, and Libya. It's hosting huge reserves of non-renewable water, in an arid climate region. The assessment of the wells Jemna CI-11 in Tunisia and the Berkaoui OKN-32 in Algeria have concluded the integrity loss of the wellbore. These issues led to CI mass-water flowing behind the casing from the CI to the CT aquifers which characterize an internal blowout where water flows from the over-pressurized CI groundwater to the shallower CT groundwater. First, the case of the Haoud Berkaoui in 1984, (OKN-32 well) has induced a CI waters flow behind the casing causing the CT water resource contamination, which is ended with a surface crater collapse over a diameter of 320 m. Second, a quite similar accident happened in Jemna in 2015, (CI-11 well) where evidence of water flowing from CI to CT through a leaked-off casing has been discovered. Jemna CI-11, Berkaoui OKN-32, and probably many other ongoing similar accidents, could be classified as regional ecological disasters by massive water resources losses and contamination. The actual situation is far from being under control and the water contamination risk remains at a very high level.

Finally, due to unsuitable drilling programs, drilling operation problems, and/or production casing corrosion, we suspect that dozens of oil and water wells may be involved in well integrity failure affecting the NWSAS groundwater resource. And since, we cannot diagnose easily internal blowout unless widespread contamination happened, we strongly recommend (1) a regional investigation and risk assessment plan which might offer better tools to predict and

detect earlier well-bore isolation issues and (2) special attention to the cement bond settlement, evaluation, and preventive logging for existing wells to ensure effective sealing between the vulnerable water tables. Besides, in the CI-11 well accident, the recovery program was not efficient and there was no clear action plan. This increases the risk of action failure or time waste to regain control of the well. Consequently, we suggest preparing a clear and efficient action plan for such accidents in order to reduce their ecological consequences. This needs a further technical detailed study of drilling operations and establishment of the suitable equipment/action plan to handle blowout and annular production accidents.