



Key Findings: Expert Evaluation of the D.A. Hughes Collier-Hogan 20-3H

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The Florida Department of Environmental Protection (DEP) released a report, prepared by ALL Consulting, LLC, examining whether a workover procedure performed by the Dan A. Hughes Company on the Collier Hogan 20-3H oil well was designed and carried out in such a way that it was not likely to result in violations of applicable groundwater quality standards in the freshwater aquifers. Below are the key findings of this report.

Key Findings

► Surface Aquifer

- Groundwater Quality: Based on June 2014 sampling results from shallow groundwater monitoring and supply wells, there is no indication that fluids injected during the workover procedure at the Collier-Hogan 20-3H well resulted in adverse impacts to the Shallow Aquifer System (SAS) exceeding applicable drinking water standards. (*Expert Evaluation of the D.A. Hughes Collier-Hogan 20-3H, pg. 3*)
- The existing monitoring well network installed by DEP surrounding the Collier-Hogan 20-3H well pad does not indicate the presence of adverse impacts to shallow groundwater being monitored. (*Expert Evaluation of the D.A. Hughes Collier-Hogan 20-3H, pg. 6*)
- The upward vertical extent of induced fracture height at the Collier-Hogan 20-3H well was approximately 14.365 feet, based on modeling by Baker Hughes. This is well within the Sunniland Formation. Therefore, the induced fractures and hydraulic fracturing fluids could not have reached the shallow freshwater aquifer. (*Expert Evaluation of the D.A. Hughes Collier-Hogan 20-3H, pg. 43*)

► Underground Source of Drinking Water

- Considering the presence of approximately 10,000 feet of intervening strata between the targeted lower Sunniland Formation and the base of the underground source of drinking water (USDW) and also the presence of multiple confining strata and low pressure zones with that intervening stratigraphic section, induced fractures, and hence hydraulic fracturing fluids or formation waters, could not have reached the USDW. (*Expert Evaluation of the D.A. Hughes Collier-Hogan 20-3H, pg. 2*)
- Considering the various site-specific and regional technical considerations, it appears improbable that the lowermost USDW was adversely impacted as a result of the design or implementation of the Collier-Hogan 20-3H well workover. (*Expert Evaluation of the D.A. Hughes Collier-Hogan 20-3H, pg. 6*)
- The depth of the lower Sunniland Formation (approximately 11,900 feet below grade) at the Collier-Hogan 20-3H assures that fracture propagation could not reach the shallow USDW with its base at approximately 1,850 feet below grade. (*Expert Evaluation of the D.A. Hughes Collier-Hogan 20-3H, pg. 41*)

► Wells 103 & 106

- For the well stimulation treatment performed in the Collier 20-3H well to have resulted in adverse impact in the lowermost USDW, pressure would have had to travel first at least 993 feet laterally (horizontally) through the formation in order to communicate with the Permit 86 well; however, Baker Hughes' stimulation modeling indicated lateral propagation was limited to 28.884 feet. The pressure would then have had to overcome the three cement plugs and the hydrostatic pressure exerted by the heavy drilling mud and forced fluid upward in the USDW. It is highly unlikely that this occurred. (*Expert Evaluation of the D.A. Hughes Collier-Hogan 20-3H, pg. 47*)
- For the well stimulation treatment performed in the Collier-Hogan 20-3H to have resulted in adverse impact in the lowermost USDW, pressure would have had to travel first 3,534 feet laterally. The pressure would then have had to overcome the three cement plugs and the hydrostatic pressure exerted by the heavy drilling mud and forced fluid upward into the USDW. It is unlikely that this occurred. (*Expert Evaluation of the D.A. Hughes Collier-Hogan 20-3H, pg. 51*)

► **Well Integrity**

- Data records do not appear to suggest an abnormal formation reaction, well integrity loss, or other potentially concerning issues. (*Expert Evaluation of the D.A. Hughes Collier-Hogan 20-3H, pg. 4*)
- Review of the various data and plots from the Post-Stimulation Report show common results for HVHF jobs. Upon assessing the subject data in detail, no specific irregularities or data that would indicate a concern were noted. Maximum BHTPs were noted to approach approximately 9,000 psi, but the scale of the charts made actual maximums difficult to assess. There was no indication that any of the seven treatment stages circulated up the backside of the 7-inch casing to 4-1/2-inch casing annular space during the well stimulation process, which would be indicative of external mechanical integrity failure. This is further supported by the zero pressure recordings on this annular space during all seven stimulation stages. Data records do not appear to suggest an abnormal formation reaction, well integrity loss or other potentially concerning issue. (*Expert Evaluation of the D.A. Hughes Collier-Hogan 20-3H, pg. 29*)