

## DOES HYDRAULIC FRACTURING THREATEN THE ARTESIAN AQUIFER SYSTEM OF THE VIRGINIA COASTAL PLAIN?

If most news sources are to be believed, hydraulic fracturing—the “fracking” of popular idiom--poses a grave threat to the artesian aquifer system of the Virginia coastal plain. So widespread is this belief that it is enthusiastically accepted by the general public as a fact. Yet, there is little scientific evidence to support the view.

First, there have been numerous accounts describing the contamination of shallow, water-table aquifers by natural-gas drilling caused chiefly by the release of methane or flowback fluids resulting from the failure of well casings and the breach of waste-water ponds; but documented reports of the contamination of deep aquifers by hydraulic-fracturing fluids are virtually unknown.

Second, the hydrogeologic conditions present in the earth at the depths typical of hydraulically-fractured shales are not conducive to the ready flow of fracking fluids through rock because the permeability--the capability of a soil or rock to permit the flow of fluids through it--of the subsurface rock layers is very low. The geologic conduits that are necessary for fluid flow are absent for several reasons.

The small porosity of fine-grained rocks like shale and siltstone and the mineral cement that fills the pore spaces of coarser-grained rock like sandstone are formidable barriers to fluid migration. Additionally, the great pressures at depth, reaching several thousand pounds per square inch, all but preclude the existence of open rock fractures, which would otherwise conduct fluids. Finally, the direction of fluid flow (including groundwater) in the subsurface is controlled by what is called hydraulic gradient. Beneath the Virginia coastal plain, the natural hydraulic gradient throughout the bulk the artesian aquifer system is predominantly from west to east and downward, making fluid migration *upward* from the gas shales of the Mesozoic rift basins into the overlying aquifers highly improbable.

In summary, it would be folly to assert that the contamination of coastal plain, artesian aquifers by hydraulic fracturing fluids is impossible under all conditions, but the hydrogeologic character of the region makes such an occurrence unlikely. Moreover, the deeper the gas shales lay below land surface, the less likely there is to be contamination. Common sense, however, should prevail.

At localities where hydrogeologic investigation identifies subsurface conditions that warn of potential problems, prudence is necessary. Additionally, in the event that fracking fluid has been discovered to have contaminated a portion of an artesian aquifer, emergency plans must be ready to mitigate the contamination, determine liability, and compensate all injured parties.

The greatest risk of harm to the people of the Virginia coastal plain from the development of shale gas comes not from the potential threat to the aquifer system from hydraulic-fracturing fluids but from the very real threat to the traditional way of life of the region by the robust industrial footprint of natural gas development.

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