

## Lack of data to support a relationship between methane contamination of drinking water wells and hydraulic fracturing

Osborn et al. (1) sampled 68 water wells located in upstate New York (Genesee formation) and northeast Pennsylvania (Catskill and Lockhaven formations). The study opined that there is systematic evidence of increased concentrations of thermogenic methane in water wells near active gas extraction areas compared with water wells outside active gas extraction areas. Average methane concentrations were 19.2 and 1.1 mg L<sup>-1</sup> for active and nonactive areas, respectively. By using isotope analysis, the study concluded that the thermogenic methane in the water wells is consistent with Marcellus shale gases.

However, the Genesee data show that average methane concentrations in nonactive area water wells was 1.5 mg L<sup>-1</sup> and the only sampled active area water well was 0.3 mg L<sup>-1</sup> (table 1 in ref. 1). This correlation is opposite of what Osborn et al. (1) concluded.

For Lockhaven, seven active area water wells were sampled. Therefore, a comparison of methane concentration between active and nonactive area wells cannot be established. A review of the methane carbon isotopes in the Lockhaven water wells shows large variability [~20‰ variation; figure 4b (1)]. If the Lockhaven water wells contain methane from gas extraction operations, one would expect the methane isotopes in the water wells to be similar to the gas extracted from the same county, and not have a wide variation. This wide isotopic variation indicates that the Lockhaven water wells are likely impacted by a mix of Lockhaven natural gases. [Figure 4b (1) presents “published gas data” from the Pennsylvanian, upper and middle Devonian, Silurian, and Ordovician formations. Those data are collected from southwest and central Pennsylvania and are not represen-

tative of the study area.] Note that the highest methane concentration reported by Osborn et al. (1) (64 mg L<sup>-1</sup>) has a carbon isotope different from the extraction operations gas. In 2005, the Pennsylvania Department of Environmental Protection collected Lockhaven water well samples from Mainesburg, Tioga County, PA, and found those wells to contain thermogenic methane with no relation to gas extraction operations (Pennsylvania Department of Environmental Protection file review conducted in 2008). This confirms that thermogenic methane unrelated to current gas extraction operations is most likely present in the Lockhaven wells and must be considered before concluding a source.

For Catskill, nonactive area water wells contained methane levels as high as 18 mg L<sup>-1</sup> [figure 4a (1)]. Eight of the 13 Catskill water wells in active areas contain concentrations lower than 18 mg L<sup>-1</sup> or have a methane isotope different from Susquehanna gas wells [figures 4 a and b (1)]. Thus, only five active area water wells have elevated thermogenic methane with isotopes similar to Susquehanna gas wells. To be able to conclusively determine if methane in those five active area water wells are related to the gas from the extraction operations, one has to analyze for carbon and hydrogen isotopes in methane and ethane. However, Osborn et al. (1) did not analyze their samples for ethane isotopes.

In conclusion, the limited data presented in Osborn et al. (1) do not support a systematic presence of thermogenic methane in private wells in the vicinity of gas extraction operations.

**Tarek Saba<sup>a,1</sup> and Mark Orzechowski<sup>b</sup>**

<sup>a</sup>*Exponent, Inc., Maynard, MA 01754; and* <sup>b</sup>*Civil and Environmental Consultants, Pittsburgh, PA 15205*

1. Osborn SG, Vengosh A, Warner NR, Jackson RB (2011) Methane contamination of drinking water accompanying gas-well drilling and hydraulic fracturing. *Proc Natl Acad Sci USA* 108:8172–8176.

Author contributions: T.S. and M.O. analyzed data and wrote the paper.

The authors declare no conflict of interest.

<sup>1</sup>To whom correspondence should be addressed: E-mail: tsaba@exponent.com.