Paper Number: 3211

South Africa's current analytical capabilities for stable isotopes with reference to compliance monitoring for hydraulic fracturing and future legislative requirements

Hohne, D.[1], Hansen, R [2] and Esterhuyse, S[3]

[1]Department of Water and Sanitation; Private Bag X5912, Upington; 8800, hohned@dws.gov.za
[2] University of the Free State; Department of Geology; PO Box 339, Bloemfontein 9300; HansenR@ufs.ac.za
[3] University of the Free State; Centre for Environmental Management; PO Box 339, Bloemfontein 9300, EsterhuyseS@ufs.ac.za

---

Isotopes can be a powerful tool in compliance monitoring for hydraulic fracturing [1,2]. As large areas of the Karoo in South Africa have been identified as potential targets for hydraulic fracturing to exploit the natural gas resources, the question needs to be asked: What is the current ability of the laboratories in South Africa to test for stable isotopes?

Only a few South African laboratories can analyse for stable isotopes and the range of stable isotopes covered is very limited. Most laboratories can only do the standard $\delta^{13}C$; $\delta^{2}H$ and $\delta^{18}O$. For hydraulic fracturing isotopes such as $\delta^{11}B$, $^{87}Sr/^{86}Sr$ and $^{36}Cl/Cl$ would be needed [1,3]. South African laboratories are not fully equipped to deal with the spectrum of isotopes that is required for monitoring water resources during shale gas and would need to extend their analytical capabilities to assure environmental compliance of hydraulic fracturing.

Internationally a limited number of studies have been conducted on the impacts of hydraulic fracturing on groundwater and surface water resources using isotopes during monitoring [1,2,4], and similarly only a few detailed studies with reference to hydraulic fracturing have been conducted using stable isotopes in the South African context. The studies by Murray et al [5] and Talma and Esterhuyse [3] are examples of two published studies.

A detailed investigation would need to be conducted, incorporating historic water-related studies that have been conducted thus far and that is relevant to unconventional gas extraction. This would form part of the groundwork that is needed together with baseline monitoring of water resources. Compliance monitoring of South Africa's scarce water resources for hydraulic fracturing operations is crucial if we want to protect it.

In this paper I review the laboratory analytical capabilities in South Africa and make recommendations in terms of upgrades that would be required at South African laboratories to effectively address the issues surrounding baseline monitoring for hydraulic fracturing operations.

References:

[1] Osborn, S.G.,Vengosh, A., Warner N.R. and Jackson, R.B.(2011) Methane contamination of drinking water accompanying gas-well drilling and hydraulic fracturing. *Proc. Natl. Acad. Sci.* 108(20): 8172–8176.

[2] Darrah, T.H., Vengosh A., Jacson R.B., Warner N.R., Poreda R.J. (2014) Noble gases identify the mechanisms of fugitive gas contamination in drinking-water wells overlying the Marcellus and Barnett Shales. *Proc. Natl. Acad. Sci.* 111(39): 14076-14081.
[3] Talma, A.S. and Esterhuyse, C. (2013) Natural methane in the Karoo: its occurrence and isotope clues to its origin. Proceedings of the 13th biennial groundwater division conference and exhibition , 17-19 September 2013, Durban, South Africa.
[4] The Council of Canadian Academies (2014) *Environmental Impacts of Shale Gas Extraction in Canada*. Ottawa (ON). The Expert Panel on Harnessing Science and Technology to Understand the Environmental Impacts of Shale Gas Extraction. Council of Canadian Academies.
[5] Murray R. et al. (2015) *The use of Chemistry, Isotopes and Gases as Indicators of Deeper Circulating Groundwater in the Main Karoo Basin*; WRC Report No. 2254/1/15. Water Research Commission, Pretoria.