Geophysical Research Abstracts
Vol. 18, EGU2016-5635, 2016
EGU General Assembly 2016

Biocides in hydraulic fracturing: hazard and vulnerability with respect to potential groundwater pollution

Fred Worrall (1), Miles Wilson (2), and Richard Davies (2)

(1) University of Durham, Earth Sciences, Durham, United Kingdom (Fred.Worrall@durham.ac.uk), (2) Newcastle University, Civil Engineering & Geosciences, Newcastle, UK.

Biocides are one possible chemical additive to frack fluids and their role is to control bacterial growth. Bacterial growth might lead to biofilm build up; and acid sulfide species and hydrogen sulfide (H2S) production: biofilm build up may reduce formation permeability and hinder gas extraction. Kahrilas et al. (2014) published a review of common biocides used in fracking in the USA. The biocides assessed in the review were the sixteen most commonly used in the USA, based on the hydraulic fracturing chemical registry Frac Focus (Frac Focus, 2015). However, the review of Kahrilas et al. (2014) contained no data or observations and so the objective of this study was to consider whether biocides proposed for use in hydrofacturing could be a threat to English groundwater.
The study considered all groundwater samples analysed for biocides in English groundwater between 2005 and 2014. The monitoring records were compared to: records of application (both amount and area); and chemical and molecular data for the biocides. The study did not use traditional adsorption and degradation data as these parameters are to prone to variability and are not pure molecular parameters. The study then used the approach of Worrall and Thomsen (2004) to consider the hazard represented by proposed frack biocides and the approach of Worrall and Kolpin (2003) to consider the vulnerability of the areas of potential shale gas exploitation.
The study showed that of the 113 biocides tested for in English groundwaters in the decade 2005 – 2014 that 95 were detected above 0.1 [U+F06D]g/l . Of these 95, 41 were compounds that were not recorded as being applied during the period of record and the detection of these 41 compounds did not decline over the 10 year period which implies very long residence times and that once compounds do pollute an aquifer then they will be a persistent problem. Furthermore, the solubility of the range of biocides used in frack fluids would imply a potentially higher hazard than for other compounds.
For one proposed area of shale gas exploitation we could show that the for the 15 km radius around the proposed frack site the total average probability of detecting a pesticide above 0.1 μg l-1 was 0.08%, while for the same group of pesticides on the national scale, the probability of detection was 0.18%, i.e. for that area the aquifer was less vulnerable to biocide pollution than would be expected.