

Is there any data as to the likelihood of existing fractures within shale bands that any potential 600m long induced fractures could intercept and act as a conduit of gas to upper aquifers?

Most, if not all, shales have natural fractures in them, and Lacazette and Geiser (2013) argued that 'hydraulic fracture fluid and fluid pressure pulses can move greater distances in pre-existing natural fracture systems'. It is critical, therefore, to have a good understanding of the structural geology of a region in which fracking is planned. This will enable the interplay of natural fractures and stimulated hydraulic fractures to be better predicted.

You made it very clear that there is little chance of problems due to fracking. However it seems the real issue will be disposal of the flow-back water. Have you looked at this important by-product of the process, particularly where there may be introduced or naturally-derived contamination (including radiation from granites)? As I understand it, under the EU Water Framework Directive this water is not allowed to be re-injected into aquifers. Has research been conducted to assess if flow-back water can be treated by conventional waste-water treatment plants?

A research paper on the naturally occurring radioactive materials (NORM) in flowback fluids has been submitted recently by members of the ReFINE team. Once it has been peer-reviewed and accepted for publication, we will make the findings public. It is correct that the re-injection of flowback water is not currently permitted in the EU. However, we have not conducted research into whether flowback water can be treated by conventional plants.

It would be slightly more objective if you overlaid maps of seismic activity against fracking locations, including the North Sea. The data you presented appeared biased – fracking has only been performed for a short period of time compared to the other caused you presented (eg reservoirs, mining, etc).

Thanks for your comment. We recognize that the different datasets have been collected over different time scales. It is apparent, however, that even after thousands of frack jobs, mainly in the USA, the likelihood of the process inducing felt seismicity is low.

Why is coal seam gas not being explored as a viable resource option in the UK?

Various companies are looking at UK coal seams as a source of gas. The main interest is in Coal Bed Methane (CBM), also known as Coal Seam Gas (CSG), where methane is extracted from coal seams by flushing fluids through them. This may or may not involve fracking. Underground Coal Gasification (UCG) is also of potential interest, in which the coal is combusted and converted into gas underground. Further information can be found on the British Geological Survey website: <http://www.bgs.ac.uk/research/energy/UCG.html>

I noted your reponse to the comment about the depth of the horizontal well at Balcombe. Given that the company are now reported as stating that they are not going to frack what is the likely impact on water supplies of the shallow horizontal well already drilled and what of the future.

The company states on its website (<http://cuadrillaresources.com/news/cuadrilla-news/article/further-information-on-our-west-sussex-planning-application/>) that it will not be carrying out any fracking of its horizontal well at Balcombe 'now or in the future'. The company does propose 'to circulate a dilute hydrochloric acid solution (90% water, 10% Hydrochloric acid) along

the horizontal length of the wellbore at pressures below the fracture pressure of the surrounding rock.' It is not clear how much water will be required to do this. It is also difficult to predict the future impact upon water supplies, as this will depend on what activities take place, and for how long.

More technically, what would you recommend as a minimum distance between two wells on the same pad?

This question is outside my area of expertise, so it would be unwise of me to make a recommendation.