Shale Gas

What’s all the fracking fuss about?

Fracking for shale gas is a hot topic here in the UK, so QEM thought it would be a good idea to sit in a darkened room and scribble down a few details.

With the depletion of other sources of natural gas, and advances in extraction technology, Shale gas exploration has become more economically viable here in the UK and all over the world.

Extraction was first trialled in the US in the 1980’s and by the late 90’s was in full production. Since then it has become an increasingly important source of natural gas in the United States, and interest has now spread to potential gas Shales in Canada, Europe, Asia, and Australia. However, exploration has stalled in many countries where traditional gas sources were preferred, and Shale extraction methods have proved controversial due to the potential for groundwater contamination and encouraging seismic movement.

The most common process for shale gas extraction is called hydraulic fracturing or ‘fracking’ using fluid to dislodge and release the trapped gas. Other methods include Nitrogen Foam Fracturing and Propellant Stimulation.

The Shale rock is a fine grained, stratified sedimentary rock that is formed from consolidated mud or clay and can be split easily into fragile plates. The gas is either trapped in the fissures or pores of the shale or is absorbed within the shale itself. Economically viable Shales are those with rich in organic material and are usually mature petroleum/gas rich rocks, where high heat and pressure have converted petroleum to natural gas. They must also be sufficiently brittle and rigid enough to maintain open fractures for extraction.
Fracking starts with a deep well (av. 8000ft) drilled into the shale formation. The well is lined with a multilayer cement casing to help prevent leaching and ground contamination. The casing is perforated using carefully placed explosives. Large quantities of fracking fluid (1-8 million gallons per well) is pumped into the shale at extremely high pressures (9000 – 15000psi) in multiple stages.

The injection pressure forces the fracking fluid into the fissures and the sand within the fluid props open the fissure and additional fluid is injected to maintain the fissure formation. The well may be fractured in stages dependent on environment and plugged/opened in stages as required. Eventually the well is depressurised and the gas laden waste fracking fluid is returned to the surface. The gas is then recovered and separated from the waste fracking fluid.
**Fracking Concern: Contamination**

Concerns of surface and groundwater contamination have mainly developed around the fracking fluid itself. The fluid consists mainly of water and sand, but also contains additives to assist with the process such as:

- Acid: to dissolve / etch the initial rock surface and provides corrosion protection,
- Scale inhibitors: Ethylene glycol,
- Disinfectants: Glutaraldehyde,
- Other additives such as gelling fluids.

Many of the additives are pollutants in their own right, and with only 40 – 80% of the fracking fluid recovered (dependent on different sources), surface and groundwater contamination is a significant risk.

In the USA there have been many reports of contamination thought to be caused by fluid releases through faults in the wells during and after gas production, and/or fractures propagating from shale formations and reaching the overlying aquifers and therefore releasing fluid into the groundwater.

However, due to poor regulatory systems, it is very hard to prove beyond any doubt that shale gas exploration was solely responsible for many of the complaints of contamination. In the USA, it is thought that state and federal regulatory controls were easy to manipulate in the early years leading to poor operator management, poor well construction, integrity validation and poor environmental management. The status of the US regulatory controls for shale gas has improved dramatically and the US Environmental Protection Agency (EPA) has recently published a progress report on The Potential Impacts of Hydraulic Fracturing on Drinking Water Resources which follows eighteen research project through the five stages of fracking water cycle, and identifying the driving factors may affect the severity and frequency of such environmental impacts.

**Fracking Concern: Seismic Activity**

The development of fracking-related seismic activity is a serious concern in areas of higher population density like the UK and Europe. A report has recently been published by The Royal Society & The Royal Academy of Engineering looking at recent ground tremors the UK, potentially caused by the Shale Gas exploration firm Cuadrilla Resources, “Shale gas extraction in the UK: a review of Hydraulic Fracturing”1. This report has looked carefully at seismic activity. The estimated magnitude of seismicity associated with hydraulic fracturing is a quarter less than that identified by studies into coal mining (no greater than 3.0 on the Richter scale).

It is anticipated that both of these issues; contamination and seismic activity, can be managed effectively by suitable regulatory control and supervision. Unfortunately for the US they have been the guinea pig for shale gas exploration and although been pioneers and paved the way for other nations to follow, there have been mistakes made and I feel the rest of the world can benefit from the lessons learnt and develop robust but not choking controls to safely and environmentally friendly manage the exploration of shale gas extraction.

The Royal Society & the Royal Academy of Engineering Report identifies 10 key recommendations that if followed should minimise the risks associated the exploration of shale gas here in the UK. The full report can be downloaded from this link here.

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1. The estimated magnitude of seismicity associated with hydraulic fracturing is a quarter less than that identified by studies into coal mining
UK: Let’s Fracking Get On With It!!

At the turn of the millennium, the UK was self-sufficient and actually exporting gas; since then, gas imports have increased and now equate to two thirds of the UK gas demand. This is only going to rise over the next couple of decades, therefore the UK needs to find alternative sources of gas or look to the greener renewable energy sources.

Shale gas in the UK is still in its infancy, and is rather an unknown to the masses and therefore seen as a threat. Currently there is only one company carrying out hydraulic fracturing for shale gas in the UK, Cuadrilla Resources Ltd. To date they have drilled and fracked one well in the Bowland shale formation, Lancashire and have four more planning applications under consideration in the Lancashire area and one in Balcombe, near Haywards Heath, West Sussex. Fracking was temporarily banned in the UK in 2011 after Cuadrilla was blamed for two earth tremors close to their Preese Hall well, measuring 2.3 and 1.5 on the Richter scale. Following investigations by Cuadrilla and the government, conclusions were drawn and mitigations put in place. The government announced in mid-December 2012 that exploratory fracking for shale gas could resume in the UK, subject to new controls outlined by Ed Davey, the Energy and Climate Change Secretary:

- A prior review before fracking begins must be carried out to assess seismic risk and the existence of faults;
- A fracking plan must be submitted to DECC showing how seismic risks will be addressed;
- Seismic monitoring must be carried out before, during and after fracking;
- A new traffic light system to categorise seismic activity and direct appropriate responses, and a trigger mechanism will stop fracking operations in certain conditions.

Since then Cuadrilla have wasted no time working closely with the authorities and according to the BBC have already submitted a planning application in December of 2012, to frac a well in Anna’s Road site in Westby.

With recent tax breaks announced by the government it’s not surprising Cuadrilla are not the only company in the pursuit of shale gas here in the UK. Coastal Oil & Gas Ltd have had several PEDL (Petroleum Exploration and Development License) applications in the last few years within in the Vale of Glamorgan with some recent success, and UK Methane Ltd have been granted four PED Licenses for exploration in the Bristol and North Somerset area with their most recent development to be near Keynsham.

With all this investment there has been speculation regarding the estimated reserves here in the UK. Cuadrilla CEO Francis Egan recently suggested 200 trillion Cubic Feet is estimated in the Bowland area, of which 10% could be extracted. Even more recently the Houses of Parliament have stated there are currently no official reserve estimates for the UK due to conflicting estimates from a variety of sources. To be honest with the ever increasing need for UK gas, it doesn’t matter how many desk based estimates are made, you’ll never know until some drilling and testing is completed. So, once the regulatory controls have been identified and implemented, let’s get drilling!

References
(1) Shale gas extraction in the UK: a review of Hydraulic Fracturing, The Royal Society & the Royal Academy of Engineering
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From the editor: We have tried to make sure the above article is as accurate and up-to-date as possible. If you think we have something wrong, or you feel we need to update it, please get in touch here.