SHALE GAS: YOUR QUESTIONS ANSWERED

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Is shale gas extraction safe?

Having reviewed the available evidence, the Royal Society and Royal Academy of Engineering have concluded that shale gas can be extracted safely with appropriate regulation. Extracting shale gas is not risk free and has to be done carefully, but the risks are manageable and comparable to other practices. The risk of seismic activity, for instance, is lower than coal mining and geothermal energy, and the risk of methane leakage is equivalent to conventional gas extraction.

While there have been rare instances in the USA of environmental damage, this has been caused by poor practice and inadequate regulation relating to general operational issues rather than the fracking process itself. These issues, such as surface spillages and leaky wells, are not indicative of an inherent problem with the technology and should be straightforward to avoid in the UK.

With a long history of onshore gas extraction, the UK has a strong track record on these issues. We also have comprehensive regulation in place covering seismicity, groundwater, and waste management, which will mean UK extractors are held to a higher standard than their US counterparts. Extractors will have to disclose the composition of frack fluid, for instance, and will not be allowed to use open pit storage or wastewater injection. Furthermore, UK extractors will be able to import best practice from the US, avoiding the same teething problems and benefiting from decades of experience.

REFERENCE

- *Shale Gas Extraction in the UK: A Review of Hydraulic Fracturing, Royal Society and Royal Academy of Engineering, June 2012*

Does fracking create radioactive waste?

When frack fluid returns to the surface it may contain Naturally Occurring Radioactive Material (NORM) that it has picked up underground. NORM is found in soil, rocks, water and air, as well as many foods such as bananas and nuts. In the USA the practice of storing flowback fluid in open pits has on rare occasions led to overspill, but in the UK this practice is prohibited: extractors must store flowback fluid safely and obtain an environmental permit from the Environment Agency or Scottish Environment Protection Agency to dispose of the process water according to an agreed waste management plan.

Managing NORM is an issue for conventional oil and gas extraction, as well as many forms of mining, which we already practise, and the UK has a strong track record with comprehensive regulation in place. The agreed waste management plan for shale gas operations will include the safe handling and management of NORM, which is a normal requirement for many extractive industries. NORM management is regulated under the Radioactive Substances Act (1993), Environmental Permitting (England and Wales) Regulations (2010), and the Radioactive Substances Exemption (Scotland) Order (2011). It is worth bearing in mind that even if a large number of wells were drilled in the UK, the amount of radioactive materials produced would be tiny compared to the amount produced by the medical sector and universities.

REFERENCES

- *An Environmental Risk Assessment for Shale Gas Exploratory Operations in England, Environment Agency, August 2013*
- *'Shale Gas in Perspective', David Mackay, August 2014, withouthotair.blogspot.co.uk/2014/08/shale-gas-in-perspective.html*

Does fracking cause earthquakes?

Fracking can induce small tremors deep underground, but these are very rare and too small to pose a risk to property or people. Fracking actually carries a lower risk of seismic activity than coal mining (which we already practise in the UK) and geothermal energy (which some opponents of fracking advocate).

Over a million fracks have taken place internationally, but only four perceptible tremors have ever been recorded (including two in Blackpool in 2011). None of these was large enough to damage property. Geologists compared the surface impact of the tremors in Blackpool, for instance, to a lorry passing by your house.

Events of this size typically happen a number of times each month in the UK for other reasons: they are recorded on the British Geological Survey website and attract little attention. In terms of surface impact, practices such as piling foundations, as well as trains and heavy traffic actually create larger felt effects all over the country on a daily basis.

It is the view of respected scientific institutions such as the Royal Society and Royal Academy of Engineering that this issue can be managed safely and the UK has put in place strict regulations to ensure this. Extractors are required to monitor seismic activity and stop operations if anything above magnitude 0.5 is recorded. This is hundreds of times below the energy level that can be felt by humans, and far outstrips standards for coal mining and geothermal energy.

It is important to note that UK extractors will not be using wastewater injection as a disposal method, which has been associated with larger and more frequent tremors in the USA in areas such as Oklahoma. This practice should not be confused with fracking, or shale gas extraction in general.

REFERENCES

- *'What Size of Earthquakes Can Be Caused by Fracking', Durham Energy Institute, April 2013*
- *Shale Gas Extraction in the UK: A Review of Hydraulic Fracturing, Royal Society and Royal Academy of Engineering, June 2012*
- *Preese Hall Shale Gas Fracturing: Review and Recommendations for Induced Seismic Mitigation, Green, Styles, and Baptie, April 2012*
- *Does Fracking Cause Earthquakes?, British Geological Survey, June 2013 https://www.youtube.com/watch?v=PF-yZgZTd8o*

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Does fracking contaminate water supplies with gas?

Shale gas extraction has on rare occasions caused methane leakage in the USA, but research has shown that this was due to leaky wells not the fracking process. A large amount of data actually shows that fracking itself does not cause methane contamination of water. This means that extraction involving fracking is no riskier in this respect than conventional gas extraction, which the UK already practices successfully.

Fracking takes place around 1-5km below ground, well below the water table, and creates thin and relatively short cracks in the rock. Data from thousands of wells in the USA show that it does not create cracks of sufficient length to allow gas to travel up to the water table. A study from Durham University found that there is less than 1% chance of a fracture extending more than 350m, making it extremely unlikely that fracking could cause methane contamination of water.

Shale gas extractors must ensure that wells are properly insulated so no gas leaks as it is brought to the surface, but this is no different to conventional gas extraction. The UK has a strong record on well integrity, having drilled over 2000 wells onshore.

Respected scientific institutions such as the Royal Society and Royal Academy of Engineering hold the view that this issue can be managed safely and the UK has strict regulation in place. The Health and Safety Executive oversees drilling operations to ensure all wells are lined with multiple layers of cement and steel casing, and the British Geological Survey has taken baseline measurements of methane levels in water around the country so the public can be confident that the industry will be monitored and held to the highest standards in the future.

It is worth remembering that there is a strong economic incentive for extractors not to cut corners, but to ensure all gas is brought to the surface without escaping. It is also important to note that typical UK households, unlike many of their US counterparts, do not source their water directly from private wells, but treatment plants, where water is purified for drinking.

It should also be noted that methane occurs naturally in water due to the decomposition of organic matter. It naturally evaporates out of water but is not considered a health risk if ingested.

REFERENCES

- *'Fracking and Aquifers: How Far Up Can a Frack Go?', Durham Energy Institute, July 2013*
- *Shale Gas Extraction in the UK: A Review of Hydraulic Fracturing, Royal Society and Royal Academy of Engineering, June 2012*
- *'Noble Gases Identify the Mechanisms of Fugitive Gas Contamination in Drinking-Water Wells Overlying the Marcellus and Barnett Shales', Darrah et al, September 2014*
- *'Oil and Gas Wells and Their Integrity: Implications for Shale and Unconventional Resource Exploitation', Davies et al, September 2014*
- *'Study Maps Fracking Methane Risk to Drinking Water', David Shukman, BBC News, July 2014*

Does fracking contaminate water supplies with chemicals?

Frack fluid is 99.5% water and sand and does not contain harmful concentrations of chemicals. There have been no reported cases of frack fluid contaminating water supplies. While the absolute volumes of chemicals used sound large when taken out of context, they are diluted in millions of gallons of water, so they are not present in harmful concentrations, which is the key factor in determining the level of risk to humans.

Typically fewer than a dozen chemicals are used in a given mixture, all of which have to be disclosed and approved as safe by the Environment Agency or Scottish Environment Protection Agency. The chemicals in question are designed to improve the safety and performance of the frack, and typically include friction reducers, water purifiers, acids to dissolve minerals, and rust resistors to protect pipes. Many of these are found in higher concentrations in household items, or are used in the purification of our drinking water. The only shale frack yet to have taken place in the UK, for instance, used 99.95% water and sand, and 0.05% polyacrylamide: a friction reducer found in face cream.

Frack fluid is typically injected 1-5km below ground, well below the water table, and either returns to the surface through the borehole (at which point it is recycled or disposed of through regulated means) or it remains thousands of feet below the water table, trapped under layers of impermeable rock. A US Department of Energy study of wells in Marcellus found that fluid does not migrate upwards and remained thousands of feet below drinking water aquifers.

Extractors must ensure wells are properly insulated and handle chemicals safely at the surface when mixing frack fluid to minimise the risk of spillage. These are straightforward engineering and safety issues, on which the UK has a strong track record, with strict regulation in place. The Health and Safety Executive oversees drilling to ensure wells are lined with multiple layers of cement and steel casing, and sites are required to be designed so as to reduce the risk of spillage, and ensure any spills are contained and cannot run off.

Any operation involving chemicals must be undertaken responsibly, but the chemicals industry handles large volumes of chemicals everyday, so it is something that can be managed safely. The Environment Agency has investigated the issue of spillages and concluded that with proper regulation the risks are ‘low’.

REFERENCES

- *Fracking UK Shale: Water, Department of Energy and Climate Change, February 2014*
- *Shale Gas Extraction in the UK: A Review of Hydraulic Fracturing, Royal Society and Royal Academy of Engineering, June 2012*
- *An Environmental Risk Assessment for Shale Gas Exploratory Operations in England, Environment Agency, August 2013*
- *An Evaluation of Fracture Growth and Gas/Fluid Migration as Horizontal Marcellus Shale Gas Wells are Hydraulically Fractured in Greene County, Pennsylvania, National Energy Technology Laboratory, September 2014*

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Is fracking compatible with our obligations to reduce climate change?

The UK is committed to using gas over the next few decades, because it is the most environmentally responsible way of meeting our energy needs as we phase out coal and move to low-carbon alternatives. Fracking is not about burning more gas, but using our own gas during this period of transition rather than relying on imports. As such, the Committee on Climate Change—the independent scientific body that sets carbon budgets for the UK—recognises that extracting shale gas is compatible with our statutory emissions targets.

The UK is committed to reducing emissions by 80% (from 1990 levels) by 2050, and has put in place ambitious policies to deliver massive investment in renewables and nuclear, such as the Carbon Price Floor and Contracts for Difference. It will take a few decades, however, to transform how the nation generates electricity and heat, so in the interim we will have to go on using fossil fuels to meet a significant portion of our energy needs.

As recognised by the Intergovernmental Panel on Climate Change, gas has half the emissions of coal, so the UK is rightly phasing out coal and focusing on gas as the best medium term option. One way to meet our need for gas is to increasingly rely on imports, as we are doing currently, but it would be better for the UK economy and our energy security to use indigenous shale gas, which has equivalent environmental performance.

One study from Cornell University has suggested that shale gas has higher levels of emissions than conventionally extracted gas, but this is at odds with the rest of the scientific literature, such as a recent study from Manchester University which corroborates the mainstream view that shale gas has equivalent lifecycle emissions. The Cornell study has been criticised for making inaccurate assumptions about levels of fugitive methane emissions, which studies have shown to be much lower in practice.

The industry is committed to minimising methane emissions through comprehensive monitoring, robustly insulating wells, and using 'green completions' and flaring as recommended in a report produced for the UK government by David MacKay and Timothy Stone. INEOS welcomes further research in this area, such as that being conducted by the ReFINE group currently, which may identify additional areas where environmental performance can be improved.

It is important to note that gas is not just a fuel that we burn for energy (thereby creating emissions). It is also a raw material used in the manufacture of chemicals that have application in a wide range of high-value products, including medicine, clothing, buildings, vehicles, computers, and green technologies, such as wind turbines and energy efficient materials. We will still need gas to make these essential items once we have made the transition to low-carbon energy. It is vital, therefore, that the UK has a secure and competitive long-term supply of gas to underpin the future of the manufacturing sector, and this is the main reason INEOS is interested in shale gas extraction.

REFERENCES

- *'A Role for Shale Gas in the Low Carbon Economy?', Committee on Climate Change, September 2013, www.theccc.org.uk/2013/09/13/a-role-for-shale-gas-in-a-low-carbon-economy/*
- *'International Panel Changes Its Tune on Gas as Way to Mitigate Climate Change', Durham University, www.dur.ac.uk/dei/energypolicyandthoughtleadership/jbcommentipcc/*
- *'Measurements of Methane Emissions at Natural Gas Production Sites in the United States', Allen et al, August 2013*
- *'Fracking's Environmental Impacts Scrutinised', Manchester University, September 2014, www.manchester.ac.uk/discover/news/article/?id=12858*
- *Potential Greenhouse Gas Emissions Associated with Shale Gas Production and Use, Mackay and Stone, September 2013*

Will fracking cause a lot of local disruption?

Like any development, a shale gas site must demonstrate that it will not lead to unacceptable visual impact, light pollution, noise or congestion if it is to secure planning permission. And while operating it must prove that it meets the conditions of its planning permission. Extractors also have to demonstrate in detail that the impact on the local environment and wildlife is acceptable to obtain an environmental permit from the Environment Agency or Scottish Environment Protection Agency.

Local disruption associated with drilling and fracking is comparable in scale to a building site, and only temporary (typically lasting about six months). After this a site produces discreetly for up to a few decades. The former Chief Scientific Adviser David MacKay has calculated that to produce a given amount of energy, a shale gas site would occupy a much smaller amount of land than a solar or wind site; it would have a much smaller visual impact; and there would be significantly less traffic, assuming water did not have to be transported to the shale gas site (which would typically be the case in the UK).

Surface operations associated with shale gas extraction produce emissions, and involve handling chemicals and wastewater, so have to be undertaken responsibly, but the Environment Agency holds the view that the risk to wildlife is low. It is important to note that no energy source is without impact on the local environment. A 2014 study from Manchester University, for instance, found that shale gas was better than offshore wind and solar on four out of 11 sustainability measures: depletion of natural resources, toxicity to humans, as well as the impact on freshwater and marine organisms.

REFERENCES

- *'INEOS Plans £2.5bn Shale Gas Giveaway', www.ineos.com/news/ineos-group/ineos-plans-25-billion-shale-gas-giveaway/*
- *'The Town Where a Form of Fracking Is Already Happening', Louise Gray, The Telegraph, August 2013*

Does fracking use a lot of water?

A frack uses about 2-6 million gallons of water, which sounds like a lot, but this is just a few days in the life of well, which may then produce for a couple of decades. It is important to put this water use in perspective on a lifecycle basis and to compare it to other practices to really understand what this means.

The Royal Society and Royal Academy of Engineering, for instance, note that the amount of water used by a shale gas well over ten years is equivalent to the amount used by an 18-hole golf course in one month, or a 1,000MW coal-fired power plant in 12 hours, or the amount lost in leaks in the northwest of England every hour. Similarly, the Chartered Institution of Water and Environmental Management (CIWEM) has recognised that compared to other fossil fuels, shale gas has relatively low water use.

The UK has better water reserves than some countries with shale gas resources, and the industry will source its water from water companies or groundwater supplies responsibly in agreement with regulators according to availability of supply. The industry body UKOOG has already entered into an agreement with Water UK to work together to minimise the impact of extraction on water resources. A significant amount of water injected deep underground is not recovered (the proportion varies depending on the geology), but the industry recycles and returns as much as possible to the water system through appropriate treatment.

REFERENCES

- *Shale Gas Extraction in the UK: A Review of Hydraulic Fracturing, Royal Society and Royal Academy of Engineering, June 2012*
- *Hydraulic Fracturing (Fracking) of Shale in the UK, CIWEM, 2014*

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Will fracking reduce my house price?

There is no material reason why fracking should lower your house price. The process does not induce tremors that are large enough to damage property, and developments only involve relatively minor and temporary disruption that must conform to standard planning and environmental requirements like any other.

In fact, INEOS is promising to share 4% of revenues with homeowners in the immediate vicinity of wells (and a further two per cent to the local community), meaning that homeownership would be associated with a potentially significant stream of revenue, putting upward pressure on house prices. We estimate that this could mean homeowners in a 10km by 10km area receive £250million over the life of a development (and a further £125 million to the local community). This is in addition to any wider economic benefits the area would receive in terms of jobs and business rates.

In this sense it is not fracking that will lower house prices, so much as misinformation that exaggerates the risks of the technology and encourages people to talk down prices. This risk, however, should subside if the technology is given the chance to go ahead and demonstrate its safety and minimal local impact.

It is worth noting that the largest onshore oilfield in Western Europe is located in Wytch Farm in the UK. The area remains a very expensive and desirable place to live, with residents reporting minimal impact. Shale gas developments are small in comparison and should be able to coexist with communities in a mutually beneficial way.

REFERENCE

- *Fracking UK Shale: Water, Department of Energy and Climate Change, February 2014*

Further facts:

- **SEPA:** www.sepa.org.uk/customer_information/energy_industry/unconventional_gas/frequently_asked_questions.aspx
- **Office of Unconventional Gas:** www.gov.uk/government/groups/office-of-unconventional-gas-and-oil-ougo
- **DECC website:** www.gov.uk/government/organisations/department-of-energy climate-change
- **UKOOG:** www.ukoog.org.uk
- **Frackland Blog:** www.frackland.blogspot.co.uk
- **No Hot Air:** www.nohotair.co.uk/index.php/library
- **ReFINE:** www.refine.org.uk
- **Frac Focus:** www.fracfocus.org
- **The Boom:** www.russellgold.net/books/the-boom
- **US EPA:** www2.epa.gov/hydraulicfracturing
- **PENN State University:** http://stateimpact.npr.org/pennsylvania/tag/fracking/
- **Range Resources:** www.rangeresources.com
- **CONSOL Energy:** www.consolenergy.com

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