January 2013

Fracking – A CHEM Trust Position Paper

This briefing sets out CHEM Trust's position on fracking. It explains what fracking is, and expands upon the associated pollution concerns. This briefing also summarises the current situation in the UK.

CHEM Trust's position

CHEM Trust has severe concerns about fracking in the UK, particularly because of its potential for intractable pollution of water resources. CHEM Trust's focus is on the pollution aspects of the technology, as its mission is to protect humans and wildlife from harmful chemicals. Therefore, the potential long term environmental contamination and possible health effects of fracking are the focus of this briefing.

We conclude that widespread fracking in the UK would pose a considerable threat, particularly to water resources.

General Environmental Impacts

The overall concerns about fracking relate to its impact on climate change, water resource depletion, air and noise emissions, earthquakes, land-take, disturbance to biodiversity and impacts related to traffic, as well as the risk of land and water contamination.

There are several ways in which fracking operations will impact on climate change. Firstly, although the natural gas (also called methane) which is produced by fracking burns more cleanly than oil, and significantly more cleanly than coal, it is still a fossil fuel that adds carbon dioxide (CO_2), to the atmosphere. Secondly, a direct contribution to global warming will accrue from any methane leakage that occurs during operations, as methane itself is a powerful global warming gas. Furthermore, the 'gold-rush mentality' or dash-for-gas will squeeze out the much needed investment and development of renewable energy. Renewable energy is the most sustainable way forward.

CHEM Trust Recommendations

Currently, in 2012, numerous EU regulatory instruments cover various aspects of fracking, but CHEM considers that there is a need for dedicated EU legislation to specifically address fracking.

To protect the wider environment, wildlife and public health, we recommend:

- A moratorium on fracking in the UK until there has been full public disclosure of all the chemicals used in fracking and the companies involved have provided adequate data on their hazard profiles, such that a full assessment

of all the potential health and environmental effects of this technology has been undertaken.
- No fracking near potable groundwater sources or on or near environmentally sensitive areas or sites of special scientific interest (SSSIs).
- Extensive air and water monitoring in the vicinity during operation.
- Detailed and on-going inspection of operations by experts in geology and ground water protection in order to ensure proper disposal of all chemicals, including contaminated water and muds etc.
- Companies undertaking fracking should have to deposit bonds sufficient to cover any future compensation claims. Measures to enforce the polluter pays principle are necessary to ensure that the proper checks and balances are in place.

Background - What is fracking?

Fracking is a method of extracting oil and gas from deep deposits in sedimentary shale rocks. In the UK, and in a great many sites in the US, the technique has been used to extract gas from deposits that were previously inaccessible, because traditional drilling was not viable as the gas came out too slowly and in small quantities. In the 1990s, fracking pioneers in the USA started to drill shale by combining two separate technologies that had been in use in the oil and gas industry for some time. These were horizontal drilling rather than vertical drilling and 'hydraulic fracturing', where water and sand is injected into the rock at high pressure. This process, called fracking, opens up cracks in the shale and allows the gas to escape in much larger volumes. Fracturing fluid, also called fracking fluid, is pumped at high pressure into the rock formation to create millimetre-sized cracks. These cracks are held open by the sand grains and other 'proppants' contained within the fracking fluid, allowing the gas to flow into the well-bore and be collected at the surface. A proppant is any material that will keep the induced fracture open, during or following a fracturing treatment, while the fracking fluid itself varies in composition depending on the type of fracturing used, and can be gel, foam or slickwater based. Apart from the added proppants, slickwater fracking fluids are mostly water, generally 99% or more by volume, but in gel-based fluids, polymers and surfactants may comprise as much as 7% by volume.

Rounds of fracturing lasting no more than one to two hours each are usually required and this process can be spaced out over several weeks while readings are taken and assessed. Once fracturing is completed, the well can continue production for 30-50 years without the need for further treatments. US experience shows that one well can be fracked perhaps10 or more times and there can be over 20 wells on one well pad.

Pollution from fracking

CHEM Trust's main concern is the pollution of water, although land and air pollution in the vicinity of the drilling is also a concern. Toxic chemicals are used at every stage of the process to reach and release the gas. Drilling muds, a combination of toxic and non-toxic substances, are used to initially drill the well. The fracking fluid that is then injected underground, under high pressure, may contain traces of diesel, and many other chemicals. Even though this fracking fluid is 'mostly water', the chemicals in this fluid have the potential to contaminate groundwater, particularly as huge volumes of fracking fluids can be used. If the fissures propagate upwards and

hit aquifers, then catastrophic pollution could result. There are also concerns that not only the fracking fluid, but also the natural gas (methane) may leak into the aquifer. Such concerns have been fuelled by on-line videos showing American householders igniting gas coming out of their water taps, purportedly as a knock-on effect of nearby fracking (see Reuters, 2012).

In fracking operations in the USA, it has been estimated that 10% - 90% of the fracking fluid will resurface, bringing back up with it toxic substances that are naturally present in underground oil and gas deposits, as well as the chemicals used in the fracking fluid. Under some circumstances, no fracking fluid is recovered and the toxic mix remains underground (Colborn et al, 2011).

Fracking depends on undisclosed types and amounts of toxic chemicals. Colborn and co-workers have compiled a list of 944 products containing 632 chemicals used during natural gas operations in the USA. Literature searches were conducted to determine potential health effects of the 353 chemicals identified by Chemical Abstract Service (CAS) numbers. More than 75% of the chemicals could affect the skin, eyes, and other sensory organs, and the respiratory and gastrointestinal systems; approximately 40-50% could affect the brain/nervous system, immune and cardiovascular systems, and the kidneys; 37% could affect the endocrine system; and 25% could cause cancer and mutations. These results indicate that many chemicals used during the fracturing and drilling stages of gas operations may have long-term human health effects, which may not immediately be apparent (Colborn et al, 2011).

In addition to the land and water contamination issues, toxic volatile compounds may escape during fracking, including benzene, toluene, ethylbenzene, xylene, etc., as well as fugitive natural gas (methane). These gases mix with nitrogen oxides (arising from vehicles and other industrial sources) to produce ground-level (tropospheric) ozone, which is detrimental to lung function (Colborn et al, 2011).

The chemicals used in fracking operations are numerous and the exact chemicals in use in the UK are largely unknown. However, for example, chemicals are added to the ‘drilling muds’ used to drill the bore hole. These include: chemicals to increase the density and weight of the fluids in order to facilitate boring; and chemicals to reduce friction to facilitate the return of drilling detritus to the surface. Chemicals are also added to the fracking fluids to perform many functions. These include, for example: acids - used to achieve greater penetration and to dissolve minerals and clays to reduce clogging and allow the gas to flow to the surface; biocides - used to prevent bacteria that can erode pipes; foamers - used to increase carrying-capacity while transporting proppants and decreasing the overall volume of fluid needed; defoamers - used to reduce foaming after it is no longer needed in order to lower surface tension and allow trapped gas to escape; friction reducers - used to make the water slick and minimize the friction created; gellants - used to increase viscosity and suspend sand during proppant transport; and surfactants - used to decrease liquid surface tension and improve the fluid passage in the pipes.

Fracking in the EU

The EU Commission’s Joint Research Centre has concluded that fracking will not make Europe self-sufficient in natural gas (JRC, 2012). Poland has revised initial

estimates of its unconventional or shale gas reserves down by 80 - 90%. France is reported to have large deposits of shale gas, but its Government has imposed a moratorium on exploration. The Commission is examining whether the environmental challenges of fracking can be effectively managed through existing regulation, monitoring and the application of industry best practices. Currently there is no specific dedicated legislation to control fracking and ensure its wider impacts on the environment, wildlife and humans are addressed.

What is the fracking situation in the UK?
The injection of fracking fluids into shales is regulated in the UK under the Water Framework Directive and Environmental Permitting Regulations (EPR) 2010, but of course many other aspects of the process and technology fall under other pieces of legislation.

So far, fracking is only a small enterprise in the UK, with Cuadrilla Resources (a UK/USA/Australian company), the only entity with a licence to drill. In 2013, it is expected to begin commercial production at one site near Preston, Lancashire. Cuadrilla has been reported to have discovered trillions of cubic metres of gas in the Bowland Basin, Lancashire, or about 17 times as much gas as was found under the North Sea (The Week, 22 Dec 2012).

Cuadrilla's fracturing near Blackpool, Lancashire, was originally deemed to pose no risk, such that an 'environmental permit' was not deemed to be necessary. This was because the nearby aquifer is saline and not connected to, or used for, public water supplies, and furthermore the nearest sensitive groundwater is many kilometres away (RS & RAE, 2012). Concerns mounted in 2011, when drilling was suspended in the UK after Cuadrilla drilling near Blackpool caused two small earthquakes. However, in December 2012, the Energy Secretary, Edward Davey, announced that fracking could continue, subject to the necessary controls and permits. After a geophysical study by the company itself, as well as a reassuring review by the Royal Society and the Royal Academy of Engineering, it has been decided that the risk of earthquakes can be managed (RS & RAE, 2012).

In the UK, the Government view is that the risks are worth taking, considering the benefits of the likely vast new gas reserves to the economy. Indeed, the Government has proposed a 'generous new tax regime' to support the industry. However, to allay the environmental fears, companies will now have to submit a fracking plan to DECC (Department of Energy and Climate Change) before consent is given. The intent of such plans is to monitor and prevent seismic activity and pollution. Operators will be required to monitor that the actual fracture is conforming to its design, and that it remains contained and far away from any aquifers (see Davey, 2012).

The Royal Society and the Royal Academy of Engineering report (RS & RAE,2012). concludes that the risk of fractures propagating to reach overlying aquifers is low provided that shale gas extraction takes place at depths of many hundreds of meters or several kilometers Moreover, Cuadrilla notes on its web-site that there are two reasons why fracking fluid will remain in the shale rock during its operations in Lancashire, even in the presence of a fault. Firstly, there is no pathway along which the fluid can travel, as natural and hydraulic fractures do not extend up to the aquifer. Secondly, a thick impermeable rock, called the Manchester Marl, lies above the

shale forming the 'regional seal'. In addition, Cuadrilla highlights that its wells have three layers of steel casing; the surface casing, the intermediate casing and the production casing, and that the intermediate casing ensures that there can be no leakage path from the shale reservoir up to the aquifer. However, CHEM Trust is still concerned that stopping fractures spreading pollutants into subterranean aquifers above the shale deposits may be impossible, if a fracture starts to spread uncontrollably. Moreover, badly managed and faulty wells may lead to gross pollution problems, as contaminated drilling fluids and atmospheric releases need careful management.

Despite the additional safeguards and more cautious approach recently announced in the UK, including on-going monitoring, there are worries that the company pushing this technology forward, that stands to make considerable financial gains, appears to be very well connected within government circles. CHEM Trust's concern is that the technology will ultimately be allowed in the UK, whatever the long term environmental cost (see http://frack-off.org.uk/the-fracking-czar-lord-john-browne).

Do potential benefits outweigh the risks?

Jobs and cheap energy are the carrot, but it is unlikely that Europe will see the 50% reduction in gas prices that have been seen in the USA over the last 4 years. This is because fracking costs will be much higher in Europe, for many reasons. Firstly, European geology is less favourable, because its shale deposits tend to be deeper underground and harder to extract. Secondly, the USA has a huge and very experienced land-based drilling industry, and competition drives down costs. Thirdly, the US has many existing pipelines, enabling drilling companies to get the gas to market, whereas Europe has no such network nor open access rules. Fourthly, Europe will hopefully require tighter regulation of the industry than in America, where arguably a wild-west mentality is still evident to some extent (Economist, 26 November 2011).

In conclusion, CHEM Trust considers that widespread fracking in the UK would pose a considerable pollution threat, particularly to water resources.

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Further resources and useful web sites
For additional publications see:
http://www.endocrinedisruption.com/chemicals.gasresources.php

For videos see:
Democracy Now! video interview with TEDX founder, Dr. Theo Colburn: The Health Effects of Water Contamination from Fracking.

Lecture by Dr Theo Colborn on "What You Need to Know About Natural Gas Production". http://www.endocrinedisruption.com/chemicals.videoplayer.php

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