

“Fracking, not welcome here – or anywhere”

Presentation to CWDF by Colin Watson, Project Consultant, Green Outlook

Colin was speaking to CWDF on 14th November 2017 on behalf of “Frack Free Dee”, a local coalition committed to opposing local fracking. Colin’s background was in the nuclear field and then Chernobyl happened and he decided that the nuclear industry was not for him. He then worked for Unilever until his retirement.

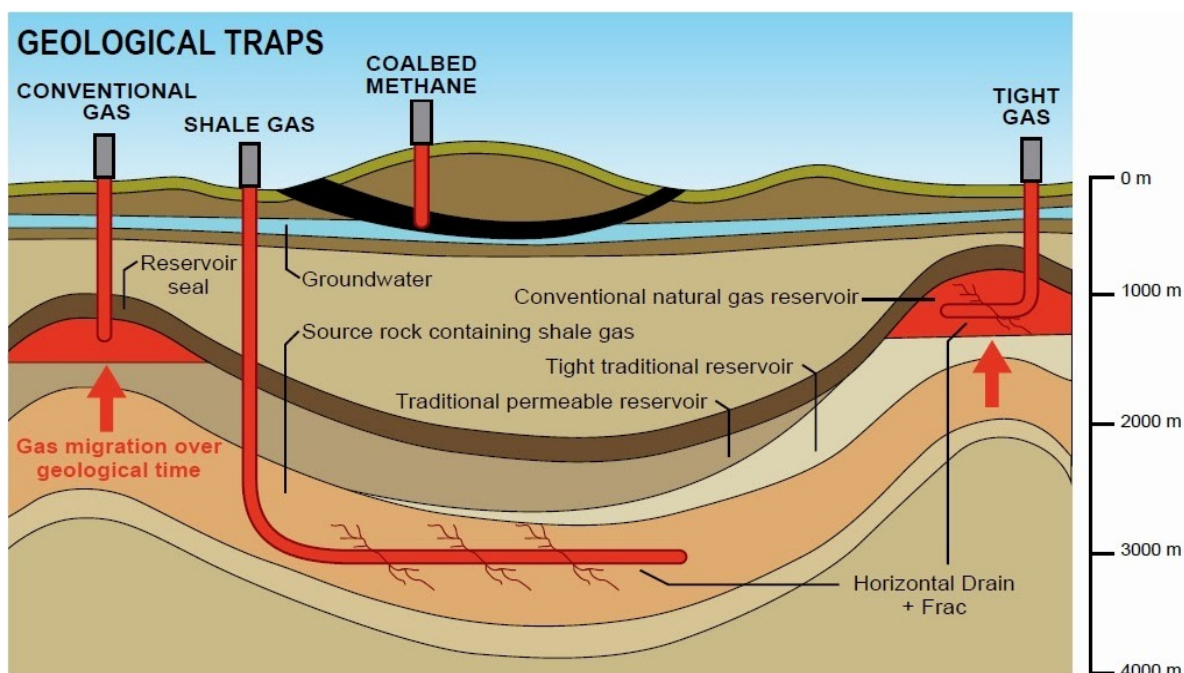
Colin first showed a film about the extraction of coal seam gas in Queensland, Australia (called shale gas in UK). 18,000 wells have been sunk, with more planned, which have completely taken over farming land and are clearly detrimental to the environment. In addition, new roads were constructed to accommodate the increased traffic associated with the fracking industry, leading to increased pollution. Other significant problems are disposal of residue soil, extra housing for the workers, and the construction of treatment works for the large volumes of waste water produced. Colin asked: do we want this in the UK?

The UK Government conducts an attitude survey on fracking every 3 months, which show people’s views on fracking have changed significantly since 2013. When those opposing fracking outnumbered those in favour, the government built a question into the survey to find out why the anti-fracking percentage was going up so much. The answer was “we found out about fracking”.

In areas of the country where fracking is threatened, surveys regularly show figures of around 80% opposed to the process. This number is also repeated in Australia and other parts of the world.

Colin commented “I invite you not to take my word on fracking, but to go and do some research of your own and to form your own view. When you do, there are a few things you need to be aware of”. There is very conclusive evidence from medical and scientific research over 20+ years in the USA about the impacts of fracking. It damages people’s health, causes pollution of water and air/noise/light pollution, brings about industrialisation of the countryside, increases serious road accidents and brings a danger of earthquakes. The Environmental Protection Agency in the USA is a good source of information.

Colin went on to explain the difference between conventional and unconventional gas extraction.



1 Conventional gas is extracted from a reservoir, created by a dome in an impermeable layer in the earth’s crust. The gas has migrated there over geological time, being filtered by the ground that it passed through. This is how North Sea gas was created – a very clean form of natural gas.

2 Shale gas is produced by fracturing the shale, quickly releasing trapped gas which travels up the well to the surface. Shale gas has not been filtered so it contains all sorts of impurities and requires treatment.

3 Coal beds are relatively close to the surface, and are flooded with water. To extract the gas you drill into the coal bed, extract the water, and the gas flows out with the water.

Tight gas is a bit of a hybrid so to keep things simple Colin did not discuss this technology.

History of fracking:

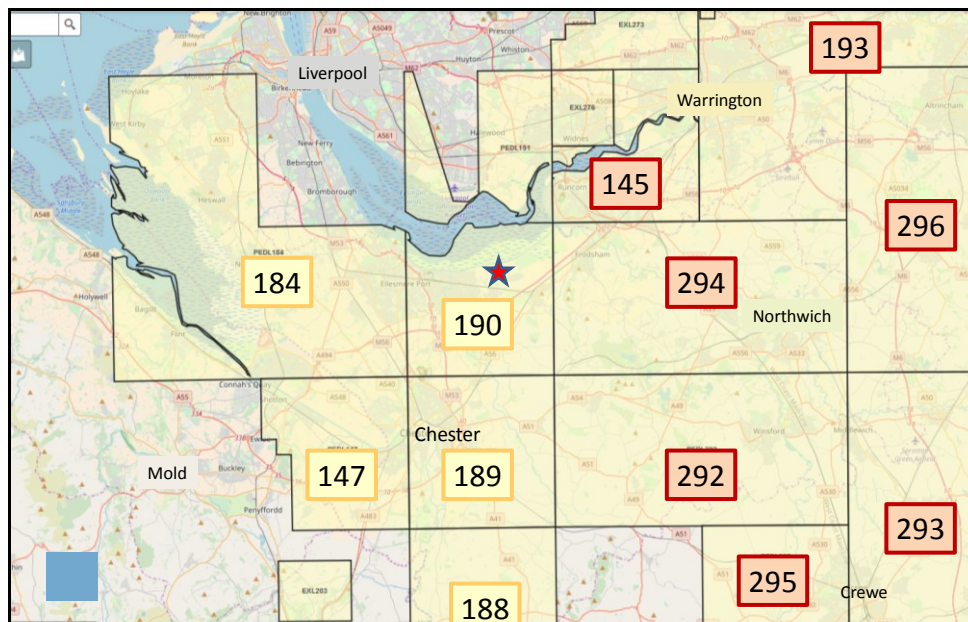
In the USA, there was an explosive growth of shale gas extraction after deregulation in 2005, and then a flattening off as gas prices dropped so that a number of US gas companies went bankrupt in 2015 / 16 as a result. Whilst fracking has been used since the 1950s to stimulate oil wells at the end of their lives:

- 1 The first successful "Unconventional Gas Extraction" took place in the USA in 1992. Unconventional gas extraction means the ability to drill vertically, then horizontally, and to fracture the rocks across a large area to release the gas contained within.
- 2 Little happened in America until the 2005 Energy Policy Act was passed, exempting the fracking companies from a lot of environmental legislation as seen in the bullet points below -
 - Compensation and Liability Act – fracking companies cannot be held liable for damages caused
 - Resource Conservation Act – fracking companies need not conserve valuable resources
 - Safe drinking water – fracking companies cannot be held liable for polluting drinking water
 - Clean air act – fracking companies cannot be held liable for polluting the air
 - National Environmental Policy Act - a whole range of other minor environmental legislation that no longer applies to the fracking industry

So 2005 was a very significant year for the fracking industry in USA. USA now has between 500,000 – 750,000 wells, while Australia has around 10,000 wells.

Shale gas production in England:

Before exploratory drilling and fracking can take place companies must obtain a Petroleum Exploration and Development Licence, or PEDL.



These are the active licenses in Cheshire. The west of Cheshire is licensed to IGas and the east of Cheshire is licensed to INEOS. Each license also has a work programme associated with it. In Chester, we are in block 184. Seismic testing takes place and if the company then thinks there may be a significant shale gas resource, test drilling follows to determine the gas content.

The following information is taken from an INEOS brochure following tests that undertaken in 1982 at a borehole that is buried somewhere under the Park and Ride on Sealand Road:

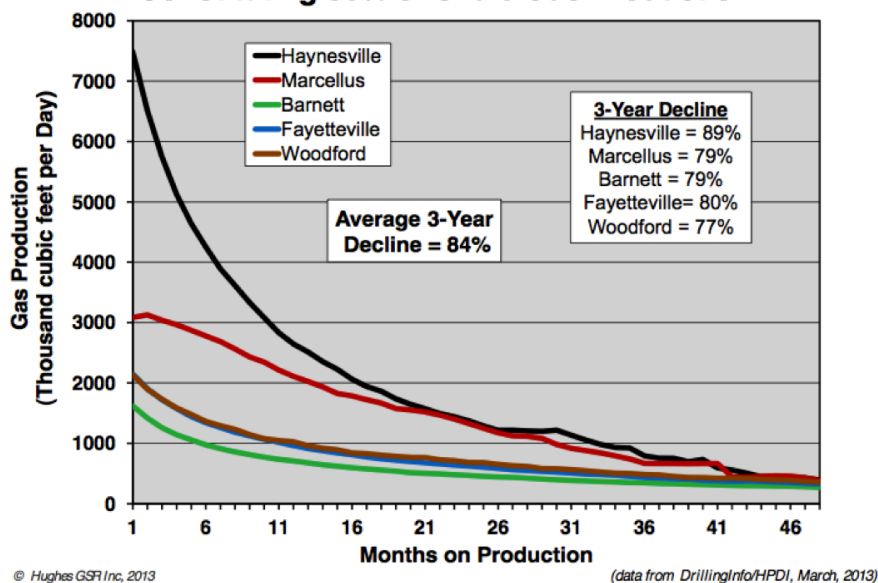
- 1 Beneath the soil there is a layer of sandstone and pebble beds. These are sufficiently porous to allow water to flow. This is the Sherwood Aquifer that supplies water to many villages and farms in Cheshire. It supplies all the water to Chester Zoo.
- 2 Beneath the aquifer is mudstone, which is less porous and helps to keep the water in the aquifer.
- 3 Beneath the mudstone we find coal seams, these are generally very thin and difficult to exploit.
- 4 Beneath the coal seams we find Bowland Shale. This is thought to have up to 5% organic matter trapped in it, which due to pressure and temperature over the eons has been converted into gas.
- 5 What is of particular concern around here is the Blacon Basin, sitting right under Chester. It is the thickest and shallowest deposit of shale in Cheshire. Will there be an application for drilling here?

The following information is taken from Cuadrilla's Blackpool planning application:

- 1 A well is then sunk into the shale deposits some 2,000m deep.
- 2 The well is then drilled horizontally along the bed of shale, to a distance of as much as 2 km.
- 3 This process generates about 5,400 tons of non hazardous waste, and 3,800 tons of hazardous waste. The non hazardous waste is drillings containing a polymer used as a drilling lubricant. Hazardous waste is drillings containing Oil Based Mud used as a lubricant when drilling through harder rock. All this waste from each well is transported by road to the appropriate type of landfill site.
- 4 Once complete the pipe is fractured to allow the fracking fluids out into the surrounding rock.
- 5 Fluid containing sand is then pumped at pressures of up to 1,000 atmospheres to fracture the shale up to a distance of 500m from the pipe. The aim is to insert sand into the cracks that are created, holding them open to enable the gas to flow out when the water is removed. 30 to 35 thousand tons of fluid is used in the fracking process. This fluid contains polyacrylamide to hold the sand in suspension, and hydrochloric acid to dissolve and open the fractures to increase the gas flow.
- 6 Additional chemicals are added to control the growth of unwanted bacteria, corrosion inhibitors to stop the primary well from going rusty, and other agents to improve the handling of the slurry.
Colin asked: do we really want to pollute the land with these hazardous chemicals?

Typical gas production

Type Gas Well Decline Curves for Top Five Shale Gas Plays Constituting 80% of Shale Gas Production



1. The graph shows that gas production declines rapidly after 3 years, when between 65% and 85% of the total gas is produced. Because of this rapid decline in gas production, new wells are constantly required and so the industry needs to drill new wells on a "rolling wave" to keep production flowing.
- 2 Most wells last for 5 to 10 years, after which they are abandoned.

So looking at the proposals for the areas around Ellesmere Port, typically how many wells would be needed between Chester and Little Stanney?

Because the frack can only extend 2 km horizontally, a lot of wells are required to extract the gas from the ground in commercial quantities. Taking evidence from an INEOS document which went out to tender in 2016, the number of wells needed would be 396 in a 10km square, which is the about the distance between Chester and the Vauxhall Factory in Ellesmere Port. Each well requires 4,000 heavy lorry movements, so fracking within this 10 km square will require in the region of 1.5 million HGV movements, and another 1.5 million LGV movements to create and service.

There would also be 12 million tons of water needed, taken from our drinking water supply, which is a little difficult to visualise. Try thinking of 24 Liverpool Anglican Cathedrals. After use, all of this water is returned and has to be removed then treated before disposal.

In reality, this is not going to happen because houses, villages and water features on the landscape will reduce this ideal plan, but you can understand the numbers of wells and truck movements that are required for commercial production. Clearly, if we are moving so many HGVs, accidents will happen, particularly on small country roads where a lot of these movements will take place. Research in the USA found that roads in counties with fracking had a fatality rate 46-47% higher than comparable counties without fracking.

It's interesting to note that, due to the number of serious crashes outside the Blackpool site, the council has had to impose a 20mph speed limit on one of the main roads into Blackpool which was previously 50 mph. So the first thing you can expect is traffic disruption. This was one of the reasons for Blackpool Council's rejection of planning permission for drilling, but it was overturned by the UK government.

The second concern is surface water contamination, because spills are inevitable spillage when you are dealing with such huge volumes of fluids. A study published in 2016, conducted by Duke University, Pennsylvania, found 3,900 fracking spills in North Dakota. These give rise to widespread contamination of land and water courses which remain polluted for several years after the spill. The study concluded that because of the dangerous chemicals found, there are significant human and ecological implications.

A further consideration - what happens when wells fail? Water and shale gas containing toxic substances will rise to the surface. The USA Minerals Management Service reviewed 6,000 fracking wells for leakage. The survey indicated that 7% of wells fail immediately, and 50% fail in within 15 years, with all wells failing eventually. Work in Australian confirms low risk of failure up to 15 years, medium risk of failure between 15 and 75 years, and almost certain failure over 75 yrs. As a yardstick, 38% of North Sea oil and gas wells are showing signs of leakage, indicating eventual failure.

It's worth noting that if wells fail and the aquifer is affected, then it is the landowner who is responsible. In America, there are over 85,000 abandoned wells which are waiting to be rectified.

Aquifer contamination

Country	Location	No. Wells studied	% Wells with barrier failure or well integrity failure	Additional information
USA	ONSHORE Operational wells in the Santa Fe Springs Oilfield (discovered ~ 1921), California, USA	>50	75	Well Integrity failures. Leakage based on the 'observation of gas bubbles seeping to the surface along well casing'.
USA	ONSHORE Ann Mag Field, South Texas, USA (wells drilled 1998–2011)	18	61	Wells drilled 1998–2011. Well barrier failures mainly in shale zones.
USA	OFFSHORE Gulf of Mexico (wells drilled ~ 1973–2003)	15,500	43	Wells drilled ~ 1973–2003. Barrier failure. 26.2% in surface casing.
Offshore Norway	OFFSHORE Norway, 8 Companies, Abandoned Wells (wells drilled 1970–2011)	193	38	Wells drilled 1970–2011. Well integrity and barrier failure. 2 wells with likely leak to surface.
China	ONSHORE Kenxi Reservoir, China (dates unknown)	160	31.3	Well barrier failure
China	ONSHORE Gudao Reservoir, China (wells drilled 1978–1999)	3461	30.4	Wells drilled 1978–1999. Barrier failure in oil-bearing layer.
Offshore Norway	OFFSHORE Norway, 8 Fields (dates unknown)	217	25	Wells monitored 1998–2007. Well integrity and barrier failure. 32% leaks occurred at well head.

Just to reinforce the point, this is a summary of failing wells from around the world as published in the Marine and Petroleum Geology Journal in 2014. We can see failure rates of 61% in Texas. One of the things that the industry says is that we will do it better in Europe. However, there is no evidence to support this statement. It seems as though we have failure in 38% of the wells in the North Sea. Who will look after these wells in 100 years time?

There are various forms of failure. Initially, this may be a small seep of gas or fluid that will increase over time. Longer term, the well will dissolve into rust, and the cement around the casing will crack and fail, leading to large scale migration of gas and fluid out of the shale beds. Over geological time, the earth will flex causing far greater failures. Complaints about contaminated water in Pennsylvania from fracking run between 200 and 300 per year. What is very concerning is that the UK's geology has 500 times more faults than the USA's. Professor David Smythe from Glasgow University, who spent a lot of his career helping to develop the North Sea oil and gas industry, considers the development of fracking onshore as a major environmental threat, and he provides

expert witness to inquiries. He has evaluated flow rates in Cheshire faults, and considers that migration of fluids to the surface will take one to two generations.

There is also considerable risk of methane (a highly potent greenhouse gas) seeping into drinking water the nearer you live to a well and take your water from a borehole. In a survey conducted again by Duke University, 115 of 141 wells were found to have higher than normal levels of gases in them. A significant number are in the hazard zone of harm to health and danger of explosions causing damage to property, which has happened. The long-term concern is that these gases are the precursors of greater flows, and other contaminants associated with fracking operations may be released.

Impact on Health

There are hundreds of studies relating to health impacts of fracking - 226 in the USA in 2015 and over 230 in the first six months of 2016 alone. The number has risen exponentially since the first few reports appeared in 2008, and long term effects become obvious. Indeed, a major study by "Concerned Health Professionals" in USA runs to 209 pages. In 2016, it called for a complete ban on fracking. The American Journal of Public Health is also now calling for a ban on the industry.

Higher Risk of Earthquakes

Can fracking processes trigger earthquakes? California has been severely hit with earthquakes due to the fracking industry including earthquakes of over magnitude 5. In 2011, the only "frack" in the UK in Lancashire caused 50 minor earth tremors. with one 1.5 and one 2.3 magnitude causing minor damage to local property. One of these tremors deformed the fracking well itself.

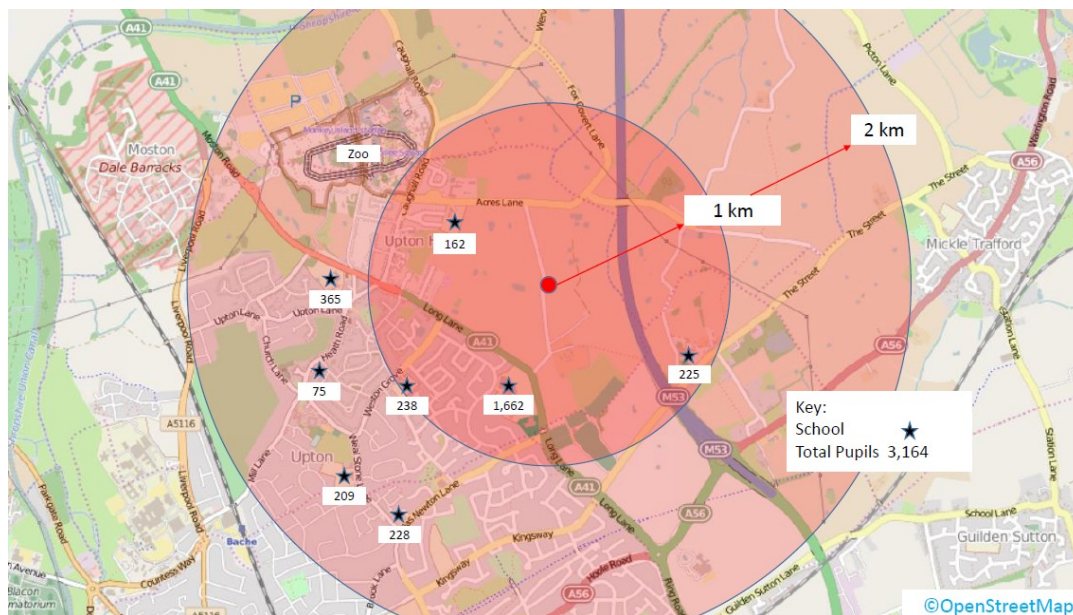
Gold Standards of Regulation for the fracking industry

Watering down of our supposed "gold standards" is already taking place: For example:

- 1 Although methane is a substance that falls under the COMAH regulations, in 2015 the government changed the legislation to exclude onshore gas wells.
- 2 The government has cut the Environmental Agency and the Health and Safety Executive to the point that there is significant concern over their ability to regulate effectively.
- 3 If you read the recent Conservative manifesto, it included a section on how fracking will become a 'permitted development'. So whilst you struggle for months to get a house extension through the local planning department, a developer can set up a test rig without planning permission. Once they have run 4,000 HGV's past your front door, then they only need to apply to an office in Whitehall to turn it into a full production facility. This is a major threat to local democracy in this country; no industry should be placed above democracy.

You may wonder what other impacts this industry might have close to home in the Chester area.

IGas on outskirts of Chester



This is the proposed site for a well on the outskirts of Chester. You can see how close to schools and residential properties it is, with over 2,000 pupils within 1 km, and over 3,000 pupils within 2 km. Chester Zoo is just over 1 km away which also draws all its water from the aquifer that the well would pass through.

Compare that with Australia: in 2013, New South Wales introduced a 2km exclusion zone around existing and future residential areas, which they further extended in 2014 to include equine and wine industries. In 2016, a report in the USA recommended that the current exclusion zone of 200 feet should be extended to 2,000 feet due to the risks from explosions and airborne pollutants.

The UK government will not do the same. Controversially, Public Health England say they cannot use the evidence from other countries, and will only act when they have evidence of ill health in the UK!
If we look at the “gold standards” applied to Cuadrilla’s operations near Blackpool:

1 The Environmental Agency requires 12 months of groundwater monitoring before development begins. This has been breached and a petition is with the EA to get them to stop Cuadrilla’s operations until this monitoring is completed.

2 The planning application indicated strict traffic management on the lorries turning off the A583. This does not seem to be in place and several serious accidents have already happened.

The fracking site near Blackpool has also had a major impact on housing – the price of a house close to the fracking site dropped by 75% and subsequently other houses in the area saw similar losses. Recently, people whose properties were flooded had problems with their house insurance if the house was close to a fracking area.

In Australia, one of the biggest mortgage lenders stopped lending if any unconventional gas extraction was taking place on or in the immediate vicinity of the property. Their logic was that no one knows what may happen in 25 years, which is the lifetime of a traditional mortgage.

Final Considerations

The UK is committed to reducing its total carbon emissions by 50% by 2030, by a further 50% in the decade to 2040, and by a further 50% in the decade to 2050. To achieve this, we must make radical changes to the ways we generate and use energy. Fracking will perpetuate our unsustainable reliance on fossil fuels, and its development diverts from efforts to exploit the abundant renewable sources of energy we have in the UK. We need to reduce our dependency on fossil fuels – not add to it. Responsible governments have acted. For instance, many states in the USA have completely banned fracking, as have some states in Australia. Those that allow fracking impose restrictions, like banning it within 2km of any human habitation. Many European countries have banned fracking. Scotland and Wales have both recently banned fracking completely.

Concluding message from Colin: “Leave the gas in the ground”

The full text and power point slides from Colin’s talk are available at www.chesterwdf.org.uk
For further information on Frack Free Dee go to www.frackfreedee.co.uk.