



Friends of the Earth Scotland Response to Consultation on Proposed Prohibition of Fracking etc. (Scotland) Bill

17 February 2017

Friends of the Earth Scotland (FoES) welcomes the opportunity to respond to this proposal for a Bill to ban unconventional oil and gas extraction (UOG), including by means of hydraulic fracturing. We are part of the Friends of the Earth International network - the world's largest grassroots environmental network, uniting 74 national member groups, over 2 million members and 5,000 local activist groups around the world. FoES is an independent Scottish charity with a network of thousands of supporters, and 10 active local groups across Scotland. Our vision is of a world where everyone can enjoy a healthy environment without exceeding their fair share of the planet's resources, now and in the future.

1. Which of the following best expresses your view of the proposal to ban onshore unconventional oil and gas extraction in Scotland?

FoES is very supportive of the proposal to ban unconventional oil and gas (UOG) in Scotland. Further, we consider that the seriousness of the potential climate, public health and other environmental impacts, as detailed below, merits a legislative approach to banning UOG, as outlined in this proposal.

2. Which of the following best expresses your view of the following statement that could be made about unconventional oil and gas extraction in Scotland: "We should be investing in renewables instead of any new fossil fuel sources"

5. Which of the following best expresses your view of the following statement that could be made about unconventional oil and gas extraction in Scotland "It could be a useful transition fuel in the move towards a low-carbon economy"

FoES strongly agrees that we should be investing in renewables instead of any new fossil fuel sources, and strongly disagrees that UOG could be useful as transition fuel in the move towards a low-carbon economy. We have responded to these two questions together because they are so interlinked.

- **The transition from fossil fuels to renewable energy is essential in responding to the climate crisis**

Burning fossil fuels is the key driver of climate change emissions. Climate change is arguably the greatest threat humankind has ever faced. The Intergovernmental Panel on Climate Change has reported with greater certainty and scientific consensus than ever before that "*warming of the climate system is unequivocal*" and that "*human influence has been the dominant cause of the observed warming since the mid-20th century*".¹ Global warming of 2°C or more will result in

¹ IPCC (2013) Fifth Assessment Report: Climate Change Working Group I Report "The Physical Science Basis"
http://www.climatechange2013.org/images/uploads/WGI_AR5_SPM_brochure.pdf

catastrophic impacts, including an increase in extreme weather events, sea level rise, the destruction of livelihoods and even entire countries, species extinction and habitat loss. In turn these impacts will see increased political instability and violent conflict, a rise in migration and climate refugees.² Scotland is not immune from these impacts nor their costs, both in incurring adaptation costs and likely detrimental impacts on key economic sectors including agriculture, fisheries and tourism. Further, in passing the 2009 Climate Change Act our Parliament recognised that as a wealthy industrialised country we have a moral responsibility to act based on our significant historical contribution to atmospheric pollution.

2016 was the hottest year on record, and global average temperatures are now sitting at 1°C over pre-industrial levels. The Paris Agreement, ratified in April 2016, commits nations to ‘holding’ global warming to ‘well below 2°C’ and pursuing efforts to limit warming to 1.5°C, in recognition of the fact that even 1.5°C warming will have devastating consequences for countries and peoples most vulnerable to the impacts of climate change. Scotland’s Climate Act requires a reduction of at least 42% in GHG emissions by 2020 and 80% by 2050, and the present Government has committed to strengthening carbon targets in response to the Paris Agreement.

Analysis by the Carbon Tracker Initiative³, an NGO which aims to improve the transparency of embedded carbon in equity markets, shows that in order to have a reasonable chance of staying below 2°C warming, 80% of the world’s proven fossil fuel reserves must not be burned unabated.⁴ Evidently, meeting the critical 1.5°C threshold means even more of these reserves must remain untouched. Most of the global shale gas and coalbed methane resources, and all of Scotland’s, are unproven and therefore additional to the more than 80% of known reserves that must stay in the ground. Scotland’s economy and energy system is heavily dependent on oil and gas from the North Sea. Therefore it is critical that instead of pursuing a new frontier of fossil fuels we invest in a diversity of renewable energy sources in order to make a speedy transition to a low carbon economy.

- **Pursuing UOG risks directing investment away from renewables**

The International Energy Agency (IEA) are amongst the experts who have warned of the danger that pursuing UOG now could limit investment in the development of renewable energy. Crucially, even the (false) anticipation of abundant, cheap gas could also have a major impact on investment in renewable energy, locking in dependence on fossil fuels well beyond what our climate targets demand. Professor Paul Stevens of Chatham House has written: “*There is a real fear among many analysts that shale gas may substitute not for coal but for renewables...the anticipation of cheap natural gas could inhibit investment in renewables. But again, if the revolution fails to deliver a lot of cheap gas, by the time this is realized it could well be too late to revert to a solution to climate change based upon renewables.*”⁵

The Government’s official advisers on climate targets, the UK Committee on Climate Change (UKCCC) has also written of the dangers of a dash for gas in relation to renewables: “*The apparently ambivalent position of the [UK] Government about whether it is trying to build a low-carbon or a gas-based power system weakens the signal provided by carbon budgets to investors [is] damaging prospects for required low-carbon investments*”.⁶ Indeed, at a UK level Whitehall’s enthusiasm for both shale gas and nuclear power have coincided with low renewables targets, lack of political support for renewables and no decarbonisation target for the electricity sector.

² IPCC (2007) Fourth Assessment Report: Climate Change Working Group II Report

"Impacts, Adaptation and Vulnerability" http://www.ipcc.ch/publications_and_data/ar4/wg2/en/contents.html

³ <http://www.carbontracker.org/team/about-us>

⁴ Carbon Tracker Initiative (2011) Unburnable Carbon – Are the world’s financial markets carrying a carbon bubble? <http://www.carbontracker.org/wp-content/uploads/downloads/2011/07/Unburnable-Carbon-Full-rev2.pdf>

⁵ Chatham House August (2012) ‘The ‘Shale Gas Revolution’: Developments and Changes’

http://www.chathamhouse.org/sites/default/files/public/Research/Energy,%20Environment%20and%20Development/bp08_12stevens.pdf

⁶ UK Committee on Climate Change (12 September 2012) ‘The need for a carbon intensity target in the power sector’ <http://www.theccc.org.uk/wp-content/uploads/2013/02/EMR-letter-September-12.pdf>

- **Scotland's energy mix, the timescales of UOG production and its carbon footprint make it highly unsuitable as a transition fuel**

Some fossil fuels release more carbon than others when burnt, coal being one of the dirtiest, and natural gas less so. This has led some to argue that shale gas could actually help in the fight against climate change. However since Longannet, the last coal-fired power station in the country, closed in spring 2016, UOG would not be replacing coal in Scotland.

Furthermore, the UOG extraction also releases accidental emissions of methane, and it is these 'fugitive emissions' that have led some scientists to warn that shale gas could be even worse for the climate than coal, let alone conventional natural gas. A key study⁷ has calculated that burning gas is only better for the climate than coal if fugitive emission levels stay below 3.2% of production, and many research projects have measured leakage levels well above this.⁸

Methane is roughly 84 times as potent as carbon dioxide as a contributor to climate change over a period of 20 years, and 28 times as potent over the span of a century. Because of its short-term potency, high methane emissions now risk pushing us over critical climate tipping points. Recent evidence from the US shows significant methane leakage previously unmeasured and unaccounted for: US methane emissions rose by 30% between 2002 and 2014,⁹ and experts are linking these emissions to the fracking industry's leaky infrastructure.¹⁰

Setting aside the issue of methane leakage, likely production timescales mean there is no place for UOG as a transition fuel in Scotland's energy future. Production scenarios outlined by KPMG in its Economic Impact Assessment of UOG for the Scottish Government have production starting to come on stream gradually from 2026, with peak production not commencing until 2044.¹¹ As laid out in the Scottish Government's recent draft Energy Strategy, gas use in Scotland is declining, with overall energy demand down by 15.2% in the past decade.¹² This move away from gas use is set to continue with a 2030 target of half of all energy to be from renewable sources, a 2050 decarbonisation target, new strategies for Local Heat, Energy Efficiency and District Heating, including the designation of energy efficiency as a National Infrastructure Priority, and proposals for an increased energy efficiency target.

- **Pursuing UOG will make it harder to meet our climate targets, and it is questionable whether the UKCCC's 'tests' for UOG development could ever be met**

The UKCCC has warned that pursuing UOG in Scotland would make it more challenging to meet Scotland's climate targets under the present Act,¹³ which as noted above, the Scottish Government plans to strengthen. The Committee sets three tests for UOG development, each of which is it hard to envisage being met:

- i. Well development, production and decommissioning emissions must be strictly limited, including:*
 - the need to strengthen regulation before production commences
 - use of methane-limiting technologies
 - the need for a methane monitoring regime
 - decommissioning liability for emissions with producer

⁷ R A Alvaraz et al., (2012) Greater focus needed on methane leakage from natural gas infrastructure, <http://www.pnas.org/content/109/17/6435.full>

⁸ Carbon Brief (2014) Explained: Fugitive Methane Emissions from Natural Gas Production, <https://www.carbonbrief.org/explained-fugitive-methane-emissions-from-natural-gas-production>

⁹ A J Turner (2016) A large increase in U.S. methane emissions over the past decade inferred from satellite data and surface observations <http://onlinelibrary.wiley.com/doi/10.1002/2016GL067987/abstract>

¹⁰ B McKibben (2016) Global Warming's Terrifying New Chemistry <https://www.thenation.com/article/global-warming-terrifying-new-chemistry/>

¹¹ KPMG (2016) Economic Impact Assessment and Scenario Development of Unconventional Oil and Gas in Scotland <http://www.gov.scot/Resource/0050/00509321.pdf>

¹² Scottish Government (January 2017) Scottish Energy Strategy: the Future of Energy in Scotland, 148 <http://www.gov.scot/Resource/0051/00513466.pdf>

¹³ UK Committee on Climate Change (2016) Scottish Unconventional Oil and Gas: Compatibility with Scottish Greenhouse Gas Emissions Targets <http://www.gov.scot/Resource/0050/00509324.pdf>

We note that the regulatory requirements outlined by the UKCCC could prove too costly and impractical for the industry to proceed on a commercially viable basis, particularly considering that an effective methane monitoring regime should include baseline monitoring ahead of planning permission. Further, methane-limiting technologies such as Reduced Emissions Completions ('green completions') require sites to be connected to pipelines in advance of well completion, which is not always viable, particularly in exploration and appraisal stages.¹⁴

ii. Fossil fuel consumption must remain in line with the requirements of Scottish emissions targets.

Further:

- 'unabated consumption of all fossil fuels [must] decline over time'
- 'there is no case for higher levels of gas consumption'
- there may be benefits if replacing imported LNG
- if Carbon Capture and Storage is not widely deployed, meeting 2050 climate targets will require elimination of almost all fossil fuel use in power generation, transport and buildings
- wide deployment of CCS could provide a way to consume some fossil fuels in a low carbon way

The draft Energy Strategy highlights that Scotland is energy-rich and as a net exporter of energy is therefore not reliant on LNG imports. In setting 2050 decarbonisation targets, the Strategy is highly over-reliant on Carbon Capture and Storage technology becoming viable on a large scale in the post 2030 period. There is a crucial interplay between the timescales involved in commercial scale UOG production and the timescales for testing CCS technology that risks locking-in gas use beyond the point we can sustain unabated gas consumption and meet our climate obligations. As noted above, KPMG's production scenarios would see UOG come on stream gradually from 2026, with peak production beginning in 2044, and continuing to 2062. The Scottish Government's draft Climate Change Plan, on policies and proposals to meet carbon targets between 2017-2032, notes that 'from the late 2020s Carbon Capture and Storage has the potential to remove CO₂ from the atmosphere'.¹⁵ It would be a remarkably risky strategy to allow UOG production to proceed ahead of securing the viability of CCS on a large scale. We note that not only is the viability of CCS on a large scale doubtful but pursuing this technology could direct investment away from more credible and economic solutions. The Scottish Government's strategy on this front is to 'seek to influence the UK Government's CCS strategy so that it is aligned with Scottish energy priorities'. Yet, having cancelled a £1bn grant competition at the end of 2015, after almost 10 years the UK Government's approach to CCS appears to be going in the opposite direction of the Scottish Government on this point. Meanwhile, the only two projects in contention for that grant award are no longer being developed following the cancellation of the prize, demonstrating the technology's heavy reliance on taxpayer support.

iii. Unconventional oil and gas production emissions must be accommodated within Scottish emissions targets.

As regards this test we would note that the UKCCC is clear in its advice that even if fossil fuel consumption does not increase as a result of UOG development, and even if production emissions are strictly regulated, 'domestic production of unconventional oil and gas will lead to some additional Scottish emissions.' Further, the Committee emphasises that 'the high level of ambition embodied in Scottish annual emissions targets means that finding offsetting elsewhere in order to accommodate even moderate additional emissions from UOG production...would be challenging.'¹⁶ Given that the Scottish Government has struggled to meet annual targets under the current Climate Act, and is proposing more ambitious targets in a new Act, it is likely to be even more challenging going forward. Any UOG production therefore would be competing for a dwindling carbon budget with either North Sea Oil and Gas reserves, which the present Government is committed to continued exploitation of, or other sectors of the economy.

¹⁴ Howarth, Santoro and Ingraffea, (2010) Methane and the greenhouse-gas footprint of natural gas from shale formations A letter <http://www.eeb.cornell.edu/howarth/Howarth%20et%20al%20%20202011.pdf>

¹⁵ Scottish Government (January 2017) Draft Climate Change Plan: The draft third report on policies and proposals 2017-2032, 2.2.4 <http://www.gov.scot/Resource/0051/00513102.pdf>

¹⁶ UKCCC (2016) Scottish Unconventional Oil and Gas: Compatibility with Scottish Greenhouse Gas Emissions Targets, pg 11 & 12

3. Which of the following best expresses your view of the following statement that could be made about unconventional oil and gas extraction in Scotland: “This is a valuable new source of energy that could stimulate the economy and create jobs”

FoES strongly disagrees that UOG is a valuable new source of energy that could stimulate the economy and create jobs.

Far from being a valuable new source of energy Scottish Government commissioned research by KPMG and UK Government commissioned research by the British Geological Survey attests that limited well and seismic data means it is unclear if the UOG industry would ever be commercially viable in Scotland. According to KPMG a spend of £240 million could be required for exploration and appraisal in order establish whether the industry is viable in Scotland. Further, the report notes that current low oil prices make for an extremely challenging economic climate in which to develop the UOG industry.¹⁷

The research by KPMG demonstrates that if the industry did go ahead, it would likely only contribute on average 0.1% GDP, based on a direct spend in Scotland of £2.2bn to 2062.¹⁸ At peak the industry could involve a maximum of 1,400 direct, indirect and induced jobs. Most of these jobs would be associated with the construction and development of well pads. KPMG notes that while jobs are created in Scotland, there is a risk they would be filled internationally¹⁹ due to skills and experience in this industry largely coming from overseas, particularly in terms of drilling and hydraulic fracturing services. The number of wells drilled does not necessarily increase the number of jobs created since workers can move from pad to pad if constructed consecutively, as experience from the US indicates is likely.

However, it is important to be aware that KPMG rely on well data from the Marcellus and Utica shales in the US in their production figures. This approach has come in for criticism since these shale plays are not comparable with Scottish shales. Geology Professor Roy Thompson of the University of Edinburgh has said that comparing the complex geology of the Midland Valley with more similar shales in the US results in a much less optimistic well output estimate, a change from the 3.16 billion cubic feet (bcf) used by KPMG to between 0.5-1 bcf over the lifetime of a well.²⁰ Reducing well output estimates by over a third clearly alters the economic scenarios outlined by KPMG significantly and calls into question even those low estimates of jobs and GDP.

Further, we note that UOG development could have a detrimental impact on local businesses, agriculture and tourism because of the health and environmental risks it poses as well as its visual impact. These impacts were not assessed in the KPMG study, and are therefore not taken into account in jobs and GDP figures. A Defra report and an investigation by journalists at the Ferret, have also suggested that UOG could have an adverse impact on house prices, estimating house prices may be affected by up to 10%.²¹

Finally we note that the ‘stranded assets’ / ‘carbon bubble’ theory has gained widespread recognition, with Bank of England Governor Mark Carney warning investors that meeting a carbon budget to avoid 2°C warming would “*render the vast majority of reserves ‘stranded’ — oil, gas and coal that will be literally unburnable without expensive carbon capture technology, which itself alters fossil fuel economics*”. Pursuing UOG production in the context of the carbon bubble therefore presents a certain risk for Scotland, as a country whose economy is already heavily dependent on hydrocarbons.

¹⁷ KPMG (2016)

¹⁸ Figures cited in this response are based on the central scenario outlined in KPMG’s report.

¹⁹ KPMG (2016), p 29

²⁰ The Times (11 February 2017) Scotland’s geology will not allow for successful fracking, says academic <http://www.thetimes.co.uk/edition/scotland/scotland-s-geology-will-not-allow-for-successful-fracking-says-academic-55db6tzjm>

²¹ Defra (2014) Draft Shale Gas Rural Economy Impacts paper https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/440791/draft-shale-gas-rural-economy-impact-report.pdf and The Ferret (December 2015) <https://theferret.scot/fracking-property-prices-scotland/>

4. Which of the following best expresses your view of the following statement that could be made about unconventional oil and gas extraction in Scotland “There are too many risks relating to pollution of the earth, water and air, and increased seismic activity.”

FoES strongly agrees that there are too many risks to make pursuing UOG a reasonable option.

There is growing evidence that UOG extraction is linked to numerous potential adverse environmental and health impacts. Communities living near gas fields report a wide range of symptoms, while academic studies point to very serious medium and longer-term effects, and researchers in the US have warned that the unconventional oil and gas industry is an ‘uncontrolled health experiment on an enormous scale’.²² Studies on the adverse health and environmental impacts of UOG are too numerous to discuss thoroughly here, but we have highlighted some key findings below.

- **Harmful chemicals used in UOG operations**

A 2011 US Government investigation questioned 14 major UOG companies and found that they were using many chemicals that are toxic to humans.²³ A 2011 study led by the Endocrine Disruptor Exchange found that of identifiable chemicals used in 944 industry products, more than 75% could affect the skin, eyes, other sensory organs, the respiratory and gastrointestinal systems; 40-50% could cause nervous, immune and cardiovascular system and kidney problems; 37% could affect the endocrine system; and 25% could cause cancer and mutations.²⁴ Exposure to endocrine disruptors is linked to sperm abnormalities, reduced foetal growth, cardiovascular disease, respiratory dysfunction and asthma,^{25,26} and studies on the long-term effects on female mice indicates reduced fertility.²⁷ High concentrations of endocrine disruptors have been documented in air and water around fracking sites.²⁸ A 2016 Yale study found that of the 1,117 water pollutants and 143 air pollutants found in fracking fluids and wastewater, 55 chemicals could be classed as known, probable or possible human carcinogens.²⁹

- **Health risks associated with UOG development**

One of the most detailed public health studies to date was conducted by the New York State’s Department of Health, leading to the state’s ban on fracking.³⁰ The review discussed numerous findings of increased symptoms consistent with exposure to chemicals used in gas fracking and drilling reported by people living near gas drilling sites, including skin rashes, nausea and vomiting, abdominal pain, breathing difficulties, coughs, nosebleeds, anxiety and stress, headaches, dizziness, eye and throat irritation. A University of Pennsylvania study found that increased rates of hospitalisation correlated with a significant increase in drilling and fracking activity in the state, and

²² Bamberger, M and Oswald, R E, (2012) Impacts of gas drilling on human and animal health, *New Solutions*, 22(1).

²³ US House of Representatives Committee on Energy and Commerce, (2011) Chemicals used in hydraulic fracturing. <http://conservationco.org/admin/wp-content/uploads/2013/02/Final-Rebuttal-Exhibits.pdf-Adobe-Acrobat-Pro.pdf>

²⁴ Colborn, T. et al., (2011) Natural gas operations from a public health perspective. *Human and Ecological Risk Assessment: An International Journal*, 17 (5), 1039-1056.

²⁵ Bienkowski, B., (2015) Scientists warn of hormone impacts from benzene, xylene, other common solvents. *Environmental Health News*. <http://www.environmentalhealthnews.org/ehs/news/2015/apr/endocrine-disruption-hormones-benzene-solvents>

²⁶ Bolden, A. L., Kwiatkowski, C. F., & Colborn, T. (2015) New look at BTEX: are ambient levels a problem? *Environmental Science & Technology*, 49, 5261-76.

²⁷ Kassotis, C. D., et al., (2016) Adverse Reproductive and Developmental Health Outcomes Following Prenatal Exposure to a Hydraulic Fracturing Chemical Mixture in Female C57Bl/6 Mice. *Endocrinology*.

²⁸ Concerned Health Professionals of New York & Physicians for Social Responsibility (2015) Compendium of scientific, medical, and media findings demonstrating risks and harms of fracking. See pp.16-51.

²⁹ Meyer, D L, (October 2016) Fracking Linked to Cancer-Causing Chemicals, New YSPH Study Finds <http://publichealth.yale.edu/news/article.aspx?id=13714>

³⁰ New York State Department of Health (2014) A public health review of high volume hydraulic fracturing for shale gas development http://www.health.ny.gov/press/reports/docs/high_volume_hydraulic_fracturing.pdf

the data examined suggested a link between well density and increased numbers of patients with heart and skin conditions as well as tumours and urological conditions.³¹

Children and babies are much more vulnerable to both pre and post natal exposure to the harmful chemicals used in UOG. A number of studies have established links between unconventional oil and gas extraction and adverse health outcomes in babies born to mothers living in the vicinity of well pads, including increases in low birth weights,³² congenital heart defects³³ and even a rise in infant mortality.^{34,35} Further, researchers from the Yale School of Public Health have recently identified 20 compounds associated with childhood leukemia and lymphoma in fracking fluids and waste.³⁶

Recent research by Health Protection Scotland commissioned by the Scottish Government confirms that despite gaps in knowledge, it is possible to establish that a number of air and water-borne environmental hazards would be likely to occur as a result of unconventional oil and gas operations if they were to go ahead in Scotland.³⁷ The Public Health Impact Assessment also highlights that workers are exposed to respirable crystalline silica (sand used as a proppant during fracking) at levels 'sufficient to pose a significant health risk'.³⁸ Exposure to silica dust is definitively linked to silicosis and lung cancer.³⁹

- **Environmental risks associated with UOG development**

Spills, leaks and accidents of hydraulic fracturing and drilling fluids or waste at the surface can pollute water, air and soil. Toxic chemicals used or mobilised by the drilling and fracking processes can contaminate nearby soils and groundwater if wells leak. Estimates put well failure on newly drilled wells at between 5-9%, and at upwards of 50% during their lifespan.⁴⁰ A 2014 study by the Pennsylvania Department of Environmental Protection revealed that 243 private water supplies had been contaminated or had lost flow and dried up as a result of nearby drilling and fracking operations over seven years, with pollutants including methane, metals and salts.⁴¹ The US Environmental Protection Agency has also recently concluded that UOG extraction has contaminated drinking water, reversing a controversial earlier position in response to mounting evidence.⁴²

Health Protection Scotland's Health Impact Assessment says there is unequivocal evidence that air and waterborne hazards 'would be likely to occur' as a result of fracking, and there is evidence that waterborne hazards are 'likely to impact negatively' on the quality of groundwater drinking

³¹ Jemielita T., et al., (2015), Unconventional gas and oil drilling is associated with increased hospital utilization rates. PLoS ONE 10, doi: 10.1371/journal.pone.0131093

³² Shaina, L. S., et al., (2015). Perinatal outcomes and unconventional natural gas operations in southwest Pennsylvania. PLoS One, 10.

³³ McKenzie, L. M., et al., (2014). Birth outcomes and maternal residential proximity to natural gas development in rural Colorado. Environmental Health Perspectives, 122.

³⁴ Solotaroff, P. (2015) What's killing the babies of Vernal, Utah? Rolling Stone <http://www.rollingstone.com/culture/features/fracking-whats-killing-the-babies-of-vernal-utah-20150622>

³⁵ American Lung Association (2013) American Lung Association state of the air 2013. <http://www.stateoftheair.org/2013/states/utah/uintah-49047.html>

³⁶ Meyer, D L, (October 2016)

³⁷ Health Protection Scotland (2016) A Health Impact Assessment of Unconventional Oil and Gas in Scotland. <http://www.hps.scot.nhs.uk/resourcedocument.aspx?resourceid=3101> p i

³⁸ Health Protection Scotland (2016) p 80

³⁹ Morris, J., Hopkins, J. S., & Jameel, M. (2015) Unequal risk: Slow-motion tragedy for American workers. The Center for Public Integrity. <http://www.publicintegrity.org/2015/06/29/17518/slow-motion-tragedy-american-workers>

⁴⁰ Friends of the Earth England, Wales and Northern Ireland (2014) Drilling without fail: A review of empirical data on well failure in oil and gas wells <https://www.foe.co.uk/sites/default/files/downloads/drilling-without-fail-review-empirical-data-well-failure-oil-gas-wells-46473.pdf>

⁴¹ Pennsylvania Department of Environmental Protection (2014) Water supply determination letters http://files.dep.state.pa.us/OilGas/BOGM/BOGMPortalFiles/OilGasReports/Determination_Letters/Regional_Determination_Letters.pdf

⁴² Ecowatch (13 December 2016) Final EPA Study Confirms Fracking Contaminates Drinking Water <http://www.ecowatch.com/epa-fracking-water-contamination-2144968213.html> and Environmental Protection Agency (2016) Study of Hydraulic Fracturing for Oil and Gas and Its Potential Impact on Drinking Water Resources <https://www.epa.gov/hfstudy>

sources.⁴³ Airborne chemicals can leak from pipes, well-heads and other infrastructure. Combined with air pollution from site traffic and equipment, the resulting air pollution is thought to be a key cause of many of the health symptoms reported by people living near gas fields.

UOG extraction creates millions of litres of wastewater per well, and commercial production could require many thousands of wells. The waste 'flowback fluid' contains both substances introduced during drilling and hydraulic fracturing and toxins naturally occurring in the ground, including carcinogens and naturally occurring radioactive materials (NORM). These wastes must be treated and disposed of extremely carefully to avoid environmental pollution and human exposure.

Research for the Scottish Government by the British Geological Society confirms that hydraulic fracturing operations can cause earthquakes.⁴⁴ While the report indicated that the risk of 'felt' earthquakes was low, smaller tremors can damage well integrity and thereby increasing the risk of pollution.

Additionally, direct risks to biodiversity from shale gas and coal bed methane development include: habitat loss and fragmentation; wildlife disturbance; and water pollution.⁴⁵

6. What do you think would be the main advantages, if any, of banning unconventional oil and gas extraction?

The main advantage of banning unconventional oil and gas extraction would be in protecting communities and the environment from the risks outlined above, and in not jeopardising our climate targets by pursuing another frontier of fossil fuels.

7. What do you think would be the main disadvantages, if any, of banning unconventional oil and gas extraction?

There are no real disadvantages to banning UOG, given that the industry has not yet established itself in Scotland.

8. Do you think that there are other steps which could be taken (either instead of, or in addition to, legislation) to achieve the aims of the proposal?

FoES considers that developing legislation to prohibit UOG is the best way to prevent the industry going ahead and achieve the various aims of this proposal.

Legislating on this important matter sends a powerful message about the need to take our climate change obligations seriously, under both domestic and international law.

We note that with powers over onshore oil and gas licensing being devolved to the Scottish Parliament under the Scotland Act (2016), and powers over environmental regulation and planning already devolved, Holyrood can legislate to ban this industry.

In June 2016 the Scottish Parliament voted to ban fracking, therefore the proposed legislation would give effect to the will of Holyrood on this matter.

⁴³ Health Protection Scotland (2016) p 73

⁴⁴ British Geological Survey (2016) Unconventional Oil and Gas Development: Understanding and Monitoring Induced Seismic Activity, <http://www.gov.scot/Resource/0050/00509318.pdf>

⁴⁵ More discussion and references in relation to the above can be found in Moore et al (2014) *Hydraulic fracturing for shale gas in the UK Examining the evidence for potential environmental impacts* http://www.rspb.org.uk/Images/shale_gas_report_evidence_tcm9-365779.pdf