

Review of the Church of England Mission & Public Affairs Council and the Environment Working Group Briefing paper on Shale Gas and Fracking

Based on “Shale Gas and Fracking” published by the Church of England December 2016. The church stated the paper gives an evidence-based factual scan of the main issues and will suggest a role for dioceses and parishes to create greater understanding and trust. It also claims to offer evidence-based ethics to Mineral Planning Authorities and assists in the planning of shale gas developments.

Author: Michael Hill, B.Sc. C.Eng. MIET.

Reviewed: Professor Peter A. Strachan, The Robert Gordon University

Date: June, 2017. Rev 3.

DISCLAIMER:

Neither the author nor any person acting on behalf the author makes any warrant or representation, express or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this report or that the use of any apparatus, method, or process disclosed in this report may not infringe privately owned rights. Further, neither the author nor any person acting on behalf the author assumes any liability with respect to the use of, or damages resulting from the use of any information, apparatus, method or process disclosed in this report.

Church of England Mission & Public Affairs Council and the Environment Working Group Briefing paper on Shale Gas and Fracking, December 2016 Independent Review

REVIEW OF PAPER BY MICHAEL HILL, B.Sc (Hons.) C.ENG. MIET, HYDRAULIC FRACTURING REGULATION EXPERT AND CONTRIBUTOR TO THE RS/RAEng REPORT, GIVEN ADVICE TO LOCAL COUNCILS & U.K. GOVERNMENT AND EXPERT ADVISER TO TECHNICAL WORKING GROUP ON HYDROCARBONS AT THE EU COMMISSION.

Following the publication of a Briefing Paper into Shale Gas by the Church of England I have been asked to examine the work and provide a brief analysis as to whether the paper met its objectives or was, in fact, a distraction to the serious debate surrounding fracking. Despite the industry being in the early stages of exploration and development the debate itself is far more advanced and is reaching maturity due to the extensive impact studies conducted both in the U.K. and U.S. and the public engagement with the issues. Unfortunately, despite information by way of presentations and independent papers given to bishops and archdeacons in the Church by the author ^(1,2) and others ⁽³⁾, their paper makes points and highlights evidence that characterised the debate much earlier on, approx. five/six years ago, and so is considerably behind current technical and sociological thinking on the facts surrounding fracking in the U.K. This has resulted in the paper giving false confidence to the public with respect to fracking safety, its regulation and its contribution to greenhouse gas (ghg) emissions. This (false) confidence may be described as “flawed” at best and is in fact potentially reckless due to the serious risks to public health by fracking being examined by many academics, engineers and institutions. The author sets out his reasons for this conclusion below.

MINOR ERRORS

The paper is littered with minor errors and inaccuracies which on their own are not significant but taken as a whole and put into the context of the fact that high volume hydraulic fracturing is a highly complex subject requiring very close attention to detail in every aspect, from engineering and science to chronology, then they become important. It demonstrates that the authors of the church paper have failed to grasp the simpler facts of fracking and so puts into question their ability to understand the more complex parts and any conclusions drawn must be treated with suspicion. I will limit my review to use four examples but there are many more. Words in italics are taken from the church’s paper. Words in bold are the author's response.

“A total of 4 wells have gone (sic) into the shale layer in the last five years”

Cuadrilla actually started drilling in 2010 and started fracking in March 2011.

“in Sept 2016 the Secretary of State approved planning appeals for two sites in Lancashire”

It was actually the 6th October that the Secretary of State for Communities overruled Lancashire County Council and gave permission for ONE of the sites ⁽⁴⁾. (The other one he will decide on at a later date).

“most observers agree that shale gas will not be as important in the U.K. as the U.S..... the U.K. has less land to drill on”

Actually, this demonstrates an astonishing level of ignorance regarding shale gas and geology. The U.K. has predominantly shale plays that are troughs whereas the U.S has more basins. The depth of such troughs is huge compared to the U.S and so the new technique of “laddering” is being proposed to maximise potential recoverability and this novel technique is planned to start with the very first exploratory wells. Land mass area as such is not relevant. Size and depth and volume of the play along with other geological factors are far more important. I am not sure which “observers” the church is referring to or even contacted but the author would contest strongly the church’s assertion. It appears more like an assumption and an incorrect one.

Church of England Mission & Public Affairs Council and the Environment Working Group Briefing paper on Shale Gas and Fracking, December 2016 Independent Review

“the amount potentially recoverable could be only 8-20%”

Actually, this is the Technically Recoverable Resource (TRR) and is a guesstimate based on US shale play recoverability rates. Cuadrilla has estimated a TTR of 10%. It could be 0.5% and as high as 20%⁽⁵⁾. A more useful measure is the proven reserve⁽⁶⁾. This is invariably much lower. Also important is the number of wells needed to extract the resource. To recover 15% some 33,000 wells will be needed, turning the north of England into a huge industrial landscape over a short period of time ⁽⁷⁾. The church paper makes no mention of this reality of Unconventional Fossil Fuel (UFF) exploration and development and the obvious implications for large-scale job losses and lifestyle degradation across the fracking zone. Previous calculations have estimated 3.75% for the Bowland shale ⁽⁸⁾.

MAJOR ERRORS

There are a number of major/important errors in the paper. There is not space to detail them all here so numerous are they and so demanding of space. One will be used as an example for all. Church paper statement in italics and author’s response below.

“The UK has one of the most stringent onshore drilling safety regimes in the world”.

This is simply not borne out by the facts and is a very dangerous and highly complacent statement to make. The author, since 2010, has been examining this very issue in great detail and has worked with many partners including the UK Gov., the industry, local councils and the Joint Research Council under the EU Commission. The U.K. has the unenviable record of having two world records in the field of oil and gas; the worst ever loss of life (Piper Alpha July 1988 – 167 died) and the worst ever environmental disaster (Deepwater Horizon April 2010 – 11 died). One an American rig in U.K. waters and the other a U.K. rig in American waters. Onshore conventional exploration has been limited in the U.K. and High Volume Hydraulic Fracturing (HVHF) has been limited to a single well in Lancashire.

The author was present on that single well, Preese Hall 1, during its drilling phase and understands its history. This is worth closer examination as it highlights the inadequacies of regulation and monitoring onshore. Before the well was fracked to stage 5/12 in April 2011, a strong debate was held between M.Hill (Engineer), M. Miller (CEO Cuadrilla) and G. Moody (Health and Safety Executive - HSE) focusing on Cement Bond Logs (CBL). Hill has previously developed Briefing Notes on “Necessary Regulations” ⁽⁹⁾ and issued them to the Dept. of Energy and Climate Change (DECC) Simon Toole. Toole invited Hill to a number of meetings in Parliament and Whitehall to discuss the lack of onshore regulation and monitoring to find a way forward. Cuadrilla did not run CBLs on the intermediate and surface casing strings for PH-1. These upper strings offer the most protection to the public and environment. Hill insisted that on all future wells this should happen as part of setting confidence levels on well integrity. Miller wrote to the HSE seeking guidance on this issue. The HSE wrote back to Hill and Miller stating there was no requirement (from them) to run CBLs. Miller informed Hill that annular pressure (AP) readings should suffice but Hill reiterated the need for CBLs as an AP reading represented a more serious stage of well integrity failure as it indicated an entire cement string had failed and so potentially a serious release of hydrocarbons/fracking fluids to the formations/atmosphere. Miller agreed with Hill and proposed to run CBLs as long as Hill (on behalf of the people of Lancashire) would inspect them. Hill agreed. By the 1st April 2011, the fracking had caused 48 tremors and two small earthquakes of sufficient seismicity to damage the well over a very large interval, including severe deformation of the casing.⁽¹⁴⁾

Church of England Mission & Public Affairs Council and the Environment Working Group Briefing paper on Shale Gas and Fracking, December 2016 Independent Review

The regulations state that the operator shall send a fax once per week to the HSE in Aberdeen. This is what forms the oversight by the HSE of the well. No onsite inspections for well integrity/construction were executed on any of the four wells drilled on the Fylde (see written answers to Hill) and none were planned. Cuadrilla did not inform the regulator of any damage to the well at that time. Three years later on 28th March, 2014 Cuadrilla discovered an AP (which would eventually settle at 342 psi) between the production tubing and the intermediate casing string. They informed the HSE of this well integrity failure and serious situation. The first response of the HSE was to request the CBL for the intermediate casing string as they needed to check the condition of the cement at the time of construction. The very CBL that 3 years earlier the HSE had criticised Hill for asking for and told the operator they did not need to run! As it did not exist they could not inspect it and both regulators (HSE and EA) had to rely on the operator's theories as to how the cement had failed and why they thought/hoped there would be no leakage as a result.

To summarise: the only well to have been fracked in the U.K., suffered an integrity failure that the HSE were not aware of for up to THREE years, suffered damage to the casing due to unpredicted induced seismicity, caused by the fracking, which the neither HSE nor the DECC were aware of for over 12 months, was never inspected once by the HSE for well integrity, which may or may not have leaked into the surrounding formations (we do not know because the EA have not checked) and which has now been abandoned.

This is the state of regulation and monitoring in the U.K. Taking into account the above summary, which is on the public record, it is simply astonishing for the church paper to conclude that regulations are the most "stringent" in the world. Such an assurance puts at risk the lives of the general public and environment. It also unfortunately demonstrates the contributors to the church paper clearly do not understand the oil and gas industry, unconventional versus conventional, how it operates onshore and have done little to no research on the sector. **Fracking is inadequately regulated and monitored. This represents a serious risk to the public and the environment, as outlined to the Government and industry in a number of papers including the RS/RAE Report in June 2012 and the follow up review in 2013 of the ten recommendations and their implementation** ⁽¹²⁾.

OTHER AREAS REQUIRING CLOSER EXAMINATION

There are numerous other errors and inaccuracies in the report, both major and minor, but it would be too space consuming to examine in this review paper. Some of these are listed below and all require further examination. Words in italics are taken from the church's paper. Words in bold are the author's response.

"It becomes important to distinguish between the arguments about fracking as a technique from arguments about how to transition to a low(er) carbon economy. And as shale gas is a cleaner option than some alternatives...shale gas has an important place in such a policy".

This statement makes no sense in the context of HVHF and its potential, as a technique, to significantly increase the U.K.'s ghg emissions over the alternatives such as coal.

Church of England Mission & Public Affairs Council and the Environment
Working Group Briefing paper on Shale Gas and Fracking, December 2016
Independent Review

“proponents of fracking maintain that it could employ many people especially in regions with high unemployment. Cuadrilla estimated 250 jobs for one test well for 12 months. Also that fracking could lower fuels bills.... It is hard to establish whether there would be any additional benefits from fracking per se”.

Why make such a statement from the industry without balancing it? The authors of the church paper have not sought out independent opinion. The reality is that there is far more risk of significant job losses in fracking areas than job gains. Cuadrilla’s own website boasts that on the Fylde they have employed 14 people (not 250) as they re-start work on 4 wells (not 1) and with the potential damage to the local tourism and farming economy, it is predicted that the Fylde could lose 10,000-15,000 jobs as fracking takes hold and employs 1,000. A significant net loss to the area. Why have the authors of the church paper not reviewed Cuadrilla’s own website which advertised the jobs created at the same time as their paper was developed? All parties conceded long ago (2013) that fracking was “highly unlikely” to lower fuels bills as stated by Lord Browne whilst Chairman of Cuadrilla. The church appears to be quite literally years behind the debate and is quoting facts that are no longer held valid by any party.

“producing more (shale) natural gas in the UK would offer greater energy security”

Shale gas may, at its height, form between 3-10% of the U.K. gas needs. Whilst this could be useful it still means 90-97% must come from other methods. Shale gas does not offer energy security.

“RS/RAE – concluded that the health, safety and environmental risks could be managed effectively in the UK by implementing and enforcing best operational practice.”

The RS/RAE published ten recommendations to ensure this was the case. 9/10 have not been adequately implemented. ⁽¹⁰⁾⁽¹¹⁾⁽¹²⁾ Consequently, the only valid conclusion is that the health, safety and environmental risks cannot be managed effectively at this time.

The church paper fails to appreciate this rather important detail. Further, the Environment Agency (EA) has stated in the permits it has issued that the Best Available Techniques (BAT) are not technically feasible and so there is, in effect, no guidance or official best practice for the industry to follow regarding fracking waste left in the target formation.⁽¹³⁾ Depending on the number of frack stages per borehole this will vary between 22m and 90m litres per borehole. The present agreed estimate for the number of boreholes needed on the Fylde for commercial viability is 6,000. **The waste containing many toxic elements as recorded by the EA ⁽¹⁵⁾, left to migrate from the target formation, will conservatively reach 132,000,000,000 litres. It is this toxic waste, left in the earth, that the EA have decided there is no BAT for and so instead have chosen to rely on statements by the operator rendering both Best Practice, Guidance and Independent regulation utterly ineffective.**

“Fracking and conflict”.

The church paper fails to highlight the primary concerns of the local population. The author of this review has executed this research over an extended time frame and it always comes back to three points; Health, Environment and Lifestyle Degradation (house values, job losses, amenity reduction, traffic grid lock, noise, light).

Church of England Mission & Public Affairs Council and the Environment
Working Group Briefing paper on Shale Gas and Fracking, December 2016
Independent Review

CHURCH PAPER CONCLUSIONS

The church paper contributors state that they undertook a thorough engagement with the evidence but it would appear from the paper that they have abdicated their responsibilities by a mistaken overreliance on the Climate Change Committee (CCC). As a result the conclusions of the paper are unfortunately highly dubious in terms of their credibility and usefulness to the reader. The conclusions reached are unreliable due to the flaws in the paper as outlined above. I will take just two of the conclusions but all are unreliable.

“Conclusion 3- the case for or against fracking depends first on conclusions about the role of shale gas in a transitional energy policy”.

Simply - NO. The industry, government, academia, residents and myself do not agree with the church’s statement. The first priority is the health of the populations living in fracking zones. Any brief review of the large number of mature, peer reviewed studies from Ivy League institutions in the US (where many States have considerably more robust and balanced regulatory regimes than the U.K.) demonstrates the serious health risks of fracking to local populations including significant increases in cancers, birth defects and chronic health complaints. This comes first not “transitional energy policy” as the church thinks, and the main actors in the debate are in agreement. The church has reached an incorrect conclusion.

“Conclusion 5: Morally acceptable depends on 1.shale gas as transitional policy, 2.robustness of regulation and 3.local planning/decision making processes.”

The author is aware that shale gas fugitive emissions make it highly unlikely to satisfy number 1. The author has written numerous papers on regulation strategy and delivery mechanisms for monitoring coupled with enforcement. He has been published in a number of journals including The Lancet and his papers used by the Government and local councils. Regulations are not sufficient and despite efforts to try and make them so, this has failed entirely over a seven year period. The planning process has been circumvented by central Government and the Sec. of State who has seen fit to overrule local borough and county councils despite these councils having considered far more evidence, over an extended period of time, than the Sec. of State. The planning system is in effect null and void. So all three key points that justify fracking as “morally acceptable” in the church’s view, fail. The church again is “persuaded a robust planning and regulatory regime could be constructed”. Whilst many things “could” happen in theory, they don’t in reality.

Church of England Mission & Public Affairs Council and the Environment Working Group Briefing paper on Shale Gas and Fracking, December 2016 Independent Review

REVIEW CONCLUSION

It is clear that the church's paper has fallen very short of the standards expected at this stage in the debate surrounding fracking in the U.K. The assertions/conclusions are years behind current thinking and show little knowledge of the industry or regulatory practices onshore for unconventional fossil fuel exploration.

Simply restating and cutting and pasting from the CCC report, industry papers and Government documents is not necessarily stating facts relating to fracking or moving the debate forward. It is often just restating vested interest opinion or where a body "would like to be" regarding a position, not actually where it is. Shale gas is not a bridge to a low-carbon economy precisely because the three tests of the CCC cannot be met and no delivery vehicle has been put in place to make sure they are.

Time and again the church paper only details one side of the argument on the majority issues they identify. That is the side of the industry or government. This could appear biased and is neither factual nor independent. Throughout the paper, the contributors state this or that body has "called for" this or that regulation or inspection to be put in place. The author of this review has studied the implementations of all the various "called for" items, such as baseline monitoring or post-abandonment examination and found that the vast majority have not been actioned. The author called for many similar items to be implemented in 2011 and six years later we are still waiting yet fracking has resumed. The time for "calling for" has gone because the time for fracking has begun. These systems need to be in place now and working, instead the church is "calling for" them to be developed at some point in the future. This is identical to the position of the RS/RAE five years earlier in 2012 ⁽¹⁶⁾. It was an acceptable position then but is very obviously not acceptable now.

In conclusion I have little choice but to request the church withdraws the paper and reconsiders its position. It is flawed and misleading and has the potential to be reckless should any person rely on it as a factual/evidence based paper on the issues pertaining to fracking.

Michael Hill C.Eng. MIET.

23rd January, 2017.

Church of England Mission & Public Affairs Council and the Environment Working Group Briefing paper on Shale Gas and Fracking, December 2016 Independent Review

REFERENCES

1. Presentation for the Bishop of Blackburn, Julian Henderson, Whaley Abbey Conference. Hill. M., May 2014.
2. Briefing Note for the Archbishop of Canterbury, Most reverend Justin Welby, Hill. M., April 2014.
3. The Challenges of Fracking, The Churches Response, The Very Reverend Christopher Armstrong, Dean of Blackburn, Nov 2014.
4. Dept. for Communities and Local Government Appeals Decision, Ref APP/Q2371/W/15/3134386,0923,4385,0924. 6th Oct, 2016
5. World Shale Gas Resources: An Initial Assessment (19tcf TRR, Cuadrilla estimated 200 Tcf GIP) and U.S. Energy Information Administration - EIA/ARI World Shale Gas and Shale Oil Resource Assessment, September 2015.
6. London School of Economics <http://www.lse.ac.uk/GranthamInstitute/fags/what-potential-reserves-of-shale-gas-are-there-in-the-uk/> Aug 2014
7. Professor Andy Alpin, Unconventional Petroleum Development, Durham University. 4th March, 2014.
8. The Oil Drum – estimate of TRR for the Bowland shale.
9. Necessary Regulation in the Exploration and Development of Unconventional Fossil Fuels. Hill. M. January, 2014
10. Shale gas regulation in the UK and health impacts of fracking. Hill.M. The Lancet. 28th June, 2014. P2211-2212.
11. Medact “Health and Fracking – The impacts and opportunity costs”, McCoy. D. Dr., Saunders. P. Dr., Hill. M., Rugman. F. Dr., Wood.R. Dr.
12. Institution of Engineering & Technology Conference “Managing the Risks” – , “Brief Review of The Royal Society/Royal Academy of Engineering Report and the present position of shale gas regulation” Hill.M., Reviewed by Slater.G., May, 2014. at the IET Meeting 20th May, 2014. Presented to the President of the OET and to Prof. Robert Mair’s (Royal Society Shale Gas Report Author) representative Prof. P. Younger.
13. Environment Agency Permitting Decisions. Issued Permits. Jan 2015. Sec 5.1.10.
14. Geomechanical Study of Bowland Shale Seismicity. November 2011. Dr.C.Paer & Dr. S. Baisch. P27-28 Wellbore Deformation.
15. Shale Gas North West – Monitoring of Flowback. Environment Agency. Dec 2011. These results used drinking water as a metric as selected by the EA. The results showed that the Lead rose to 1438 times the average level found in mains water. All of the following figures relate to the amount more than mains water. Cadmium 150x, Chloride 6,874x, Chromium 636x, Aluminium 198x, Arsenic 47x, Iron 17,979x and Radioactive Material averaging 90x the safe level. This from just one fracked well and only to stage 5. 30 stage + frack jobs are now the plan and potentially rising to 100 frack stages.
16. The Royal Society – Shale Gas Extraction in the UK: a review of Hydraulic Fracturing. June 2012. Prof. Mair. R. Page 7- Recommendations.

GLOSSARY

HVHF:	High Volume Hydraulic Fracturing
UFF:	Unconventional Fossil Fuels
EIA:	Environmental Impact Assessment
DECC:	Dept. of Energy and Climate Change
EA:	Environment Agency
HSE:	Health and Safety Executive
OSD:	Offshore Safety Division
CBL:	Cement Bond Log
BSOR:	Borehole Site and Operations Regulations. 1995.
DCR:	Offshore Installations and Wells (Design and Construction). 1996.
MSDS:	Material Safety Data Sheet (standard availability across Pharma/Chem industry)
CCC:	Climate Change Committee
RS:	The Royal Society
RAE:	The Royal Academy of Engineering

Church of England Mission & Public Affairs Council and the Environment Working Group Briefing paper on Shale Gas and Fracking, December 2016 Independent Review

AUTHOR

Michael Hill is a Chartered Electrical Engineer. He studied Electrical and Electronic Engineering at Loughborough University following sponsorship by Marconi Avionics Ltd. Mike worked in oil and gas as a wireline engineer and then as the engineer on seismic survey crews in the 1990s. He's now a director of a small engineering consultancy specialising in process automation of oil and gas rig equipment. Since March 2010 Mike has been researching regulations into onshore exploration and development.

He has written several papers on regulating shale gas and has also been published in local and national media including The Lancet, The Guardian and The Times. Mike has also worked on news articles with the BBC, ITV, Bloomberg, RTL (German TV) and the Dutch national broadcaster – NOS. He was a key contributor to The Medact Report on fracking.

He has consulted/advised/given evidence to: The Dept. of Energy and Climate Change (U.K. Gov.), The European Commission Joint Research Council, Office for Unconventional Gas and Oil, the local councils (FBC, WBC, LCC), The Royal Society, the UK Regulators (HSE, EA), NGOs (FoE, COOP, RAFF, EKAF, REAF, FFF), the British Geological Survey, The Churches in Lancashire Group and the industry. He has spoken at numerous conferences, Q&A Panels, public meetings, professional bodies and in the media. He lives in Lytham St. Annes, Lancashire, England.