

Dr Jan Wright
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Dear Dr Wright

Official investigation into hydraulic fracturing

Introduction

1. Straterra refers to your official investigation¹ into the well completion technique or technology known as hydraulic fracturing, fracture stimulation, or fracking², announced on 28 March 2012.
2. In light of the public concern generated in New Zealand over fracking in the last year or so, Straterra views² the investigation by the Office of the Parliamentary Commissioner for the Environment (PCE) as being a significant contribution to this issue.
3. At stake is the future of the petroleum industry, and, potentially, the geothermal energy³ industry in New Zealand. As is the case overseas⁴, shale gas and coal-seam gas hold the potential for greatly improving New Zealand's energy security and affordability, as well as assisting New Zealand's energy transition over time away from coal and towards less emissions-intensive sources of energy. All of that is consistent with the New Zealand Energy Strategy 2011-2021⁵, and the Government's Green Growth agenda.
4. On the last, we refer to Recommendation 25 of the Green Growth Advisory Group's report⁶ to the Government, published in April 2012, which calls for: *"the Government [to] seek the necessary discourse towards greater consensus among New Zealanders on what of our petroleum and mineral resources should be available for extraction and under what circumstances"*. Your investigation is consistent with this approach, favouring mature and evidence-based debate, which Straterra upholds as a cornerstone of our advocacy⁷ on resource sector issues.
5. It is noted that the PCE has not invited broad public input in forming its views on fracking, accepting this is normal practice for the PCE when conducting investigations. We understand that the PCE has visited some sites in Taranaki, to gain first-hand knowledge of fracking, and that it has sent letters to various firms seeking information

¹ PCE announcement of official investigation into fracking <http://www.pce.parliament.nz/media/media-releases/pce-to-investigatefracking/> 2

You are welcome to visit Straterra's web pages on fracking <http://www.straterra.co.nz/Fracking>

² TVNZ One News <http://tvnz.co.nz/national-news/fracking-investigator-has-strong-power-4806004>

³ Engineered geothermal systems are being developed in other countries using fracking techniques to create underground heat exchangers <http://www.geothermalworldwide.com/egs.html>

⁴ Reuters Jan 2012 <http://www.reuters.com/article/2012/01/25/column-fracking-climate-idUSL5E8CP2HL20120125>

⁵ NZES 2011-2021 <http://www.med.govt.nz/sectors-industries/energy/pdf-docs-library/energy-strategies/nz-energy-strategy-lr.pdf>

⁶ Greening NZ's Growth, Dec 2011 <http://www.med.govt.nz/sectors-industries/environment/pdf-docslibrary/Greening%20New%20Zealands%20Growth.pdf>

⁷ Straterra Home <http://www.straterra.co.nz/Straterra+Home>

on their activities. As well, Straterra is aware of a number of industry interests that have voluntarily provided relevant information for the PCE's consideration.

6. In recognition of the importance of the PCE's investigation, Straterra takes this opportunity to make a contribution to this debate.
7. In so doing, Straterra has consulted directly with a range of interests, including our members: Solid Energy New Zealand, New Zealand Energy Corp, and Todd Energy, who have interests or potential interests in fracking for petroleum. In the course of researching the fracking issue, in particular since the publication of a controversial report⁸ to the European Parliament of June 2011, we have drawn also on a wide range of sources of expertise, advice and evidence, from New Zealand and overseas.

Focus of Straterra's submission – a call to separate fact from fantasy on fracking

8. The fracking furore echoes other debates that have polarised New Zealand society, such as genetic modification, and the use of 1080 poison in pest control. In the latter cases, a royal commission of inquiry⁹ and the PCE¹⁰, respectively, found in favour of the "careful use" of GM, and to "use more" 1080. In both cases, there were fears for the environment and human health, which the science and the practice showed to be unfounded, provided the risks are identified and managed appropriately.
9. To assist the PCE, we examine the nature of the controversy over fracking, and provide arguments to support our contention that much of this controversy is based on one of, or a combination of ignorance, misinformation, ideology, misuse of evidence, and perceptions of inadequate regulation in New Zealand. (Certainly, Straterra supports the freedom of speech. We also believe that sunlight is the best disinfectant - and that for the facts to speak for themselves, they must be first understood.)
10. To elaborate, Straterra believes the controversy surrounding fracking in New Zealand has arisen principally from overseas reports and other material, starting with the 2010 Gasland¹¹ documentary, which are flawed, or have been interpreted selectively or incorrectly, to support a negative view of fracking, and/or of petroleum development generally, in New Zealand, and overseas.
11. In response to any claim that Straterra has been selective in its presentation of the fracking issue, in seeking to dismantle the case made by opponents of fracking, we have this to say. In our research of the fracking issue, we have read and consulted widely. In this research we have found almost no examples of sub-standard reporting on our side of the debate – the view that fracking technologies are amenable to risk management, while promoting economic and climate change benefits. One exception we have found is para. 52 of an otherwise excellent

⁸ Impacts Of Shale Gas And Shale Oil Extraction On The Environment And On Human Health, June 2011

http://www.lbst.de/ressources/docs2011/ShaleGasStudy_English_Final.pdf

⁹ Report of the Royal Commission on Genetic Modification, 2002 <http://www.mfe.govt.nz/publications/organisms/royalcommission-gm/index.html>

¹⁰ Evaluating The Use Of 1080, 2011 <http://www.pce.parliament.nz/assets/Uploads/PCE-1080.pdf>

¹¹ Gasland 2010 <http://www.gaslandthemovie.com/>

overview report¹² on fracking and shale gas by a UK think-tank, the Global Warming Policy Foundation¹³. That is in respect of the issue of drinking water contamination in Dimock, Pennsylvania, as a result of fracking, to which we return in paras. 30, 38 and 49 of this submission.

Fracking and earthquakes – a case study of misinformation

12. To argue our views, we turn now to the debate occasioned by the earthquakes that occurred near Blackpool, Lancashire, in April and May 2011, as a case study. As a direct result, Christchurch City Council¹⁴ placed a moratorium on fracking within the city's boundaries in April 2012, with Mayor Bob Parker calling for other councils to follow. At the time Green list MP Gareth Hughes likened the "*frack-free*" campaign to the nuclear-free movement, "*which swept through New Zealand*". Dunedin City¹⁵ voted to impose a moratorium in July 2012.
13. The European Parliament report referred to in para. 7 of this submission drew attention to the Blackpool earthquakes, citing as evidence a news item in a Swiss newspaper, noting that the fracking company, Cuadrilla Resources, had placed their operations on hold pending an investigation.
14. The EP report also mentioned a swarm of small earthquakes in Arkansas, inferring this could have been caused by fracking. But it failed to mention the Arkansas Geological Survey¹⁶ has been following earthquakes in the State since 1969, including swarms occurring well before fracking activity started. The AGL has an interest because of large earthquakes that occurred in the State in 1811-12. The EP report also cited as evidence, of the link between earthquakes and fracking, a Russian research paper that focused on petroleum extraction by conventional means, and not fracking. That is to say this report was a flimsy piece of research on the links between fracking and earthquakes, and, indeed, generally.
15. Returning to the Blackpool earthquakes, research commissioned by Cuadrilla Resources¹⁷ showed that the 2.3 and 1.5 Richter scale magnitude events had resulted from fracking.
16. In particular, the report¹⁸ showed that a part of a stressed fault plane, "lubricated"¹⁹ by fluid resulting from fracking activity, slipped a few millimetres. The tremors were too small to cause any damage on the surface, and would have been barely felt by humans, if at all.
17. As an aside, the report also discounted the possibility of fracking fluids migrating up into the water table, an issue addressed later in this submission.

¹² The Shale Gas Shock, 2011 http://marcellus.psu.edu/resources/PDFs/shalegas_GWPF.pdf

¹³ It is noted the GWPF is often regarded as a body of climate change skeptics, however, its report discusses shale gas as a lowcarbon alternative to coal, among other benefits.

¹⁴ NZ Herald 12 April 2012 http://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=10798417

¹⁵ Otago Daily Times, 25 July 2012 <http://www.odt.co.nz/news/dunedin/218503/dcc-backs-fracking-moratorium>

¹⁶ Arkansas Geological Survey <http://www.geology.ar.gov/geohazards/earthquakes.htm>

¹⁷ Cuadrilla Resources web pages <http://www.cuadrillaresources.com/protecting-our-environment/seismicity/what-happened/>

¹⁸ Geomechanical Study of Bowland Shale Seismicity Synthesis Report, Nov 2011

http://www.cuadrillaresources.com/wpcontent/uploads/2012/02/Final_Report_Bowland_Seismicity_02-11-11.pdf

¹⁹ The use of the term "lubricate" in this context is not technically correct. Fault slip occurs as a result of increased shear stress along the fault; or decreased shear resistance, in the case of fracking, because of increased pore pressure at the fault.

18. To reach the above conclusions demands a considerable knowledge of geology and engineering. This is because this is a technical report, written for a technical audience. Unfortunately, readers in New Zealand and elsewhere seized uncritically on the report, and claimed, for example, that fracking in Canterbury could set off another Christchurch earthquake.
19. In particular, Spreydon-Heathcote Community Board member Paul McMahon was reported²⁰ as saying in November 2011: *"I do not like the idea that somewhere out in rural Canterbury there is someone with a permit that might effectively allow them to unwittingly lubricate a faultline"*. In light of recent events in Christchurch, that was an inflammatory claim, and it produced a frenzy of public concern. As noted in para. 16, "lubricate" is the wrong term.
20. Straterra published a press release²¹ on 4 November 2011, with an attached opinion produced by GNS Science²², to explain what the report said, and to allay people's fears.
21. During this time, and for the same reasons, Taranaki Regional Council commissioned GNS Science to produce a report on the seismicity risk in Taranaki in relation to fracking. Published in February 2012 the report²³ found that: *"Almost all damaging earthquakes start at least 5 – 10 km underground and require a fault to slip over a length of several kilometres as a minimum, with lateral formation movement of tens of centimetres or more, resulting in a [Richter scale] magnitude of at least 4-5 (at least 1,000 to 30,000 times more energetic than occurs with hydraulic fracturing). Hydraulic fracturing typically involves fault slip over a length of a few metres to perhaps one hundred metres long, with actual lateral movement of a few millimetres. The pore pressure effects that could be generated by hydraulic fracturing will dissipate as the pressure front spreads, and before they can reach the depth that is generally understood to be necessary to trigger damaging earthquakes. Based on overseas examples, the maximum seismic event that could be credibly envisaged in Taranaki due to hydraulic fracturing is an event of about 2. Such an event would be very shallow and non-damaging, but would be felt nearby."*
22. None of this research and communication appeared to lessen opposition, although it did reveal that the issue is more complex than painted by fracking opponents. The Government steadfastly declined²⁴ to impose a national moratorium on fracking - against repeated invitations to do that by the Green Party and others - on accepting industry views²⁵ that fracking in New Zealand can be managed to acceptable environmental and human health standards.

²⁰ The Star, 7 Nov 2011 <http://www.starcanterbury.co.nz/news/fears-fracking-could-cause-quakes/1163783/>

²¹ Straterra press release, 4 Nov 2011 http://www.straterra.co.nz/uploads/files/straterra_pr_fracking_nov_2011.pdf

²² GNS Science opinion of fracking and earthquakes, Nov 2011 <http://gns.cri.nz/Home/News-and-Events/MediaReleases/Commentary-on-fracking>

²³ An Assessment of the Effects of Hydraulic Fracturing on Seismicity in the Taranaki Region, Feb 2012 <http://www.trc.govt.nz/assets/Publications/guidelines-procedures-and-publications/hydraulic-fracturing/gns-seismic-feb2012.pdf>

²⁴ The Press, 27 Feb 2012 <http://www.stuff.co.nz/the-press/opinion/perspective/6483146/Energy-minister-rejects-moratorium-onfracking>

²⁵ Straterra web pages <http://www.straterra.co.nz/Fracking>

23. In any event, the PCE decided to investigate, as discussed, a step welcomed by the Government²⁶, Straterra, and others. Local moratoria on fracking followed, notably in Christchurch (as discussed in para. 12).
24. Returning to the UK, the Royal Society and the Royal Academy of Engineering reported²⁷ in June 2012 that *“the health, safety and environmental risks associated with hydraulic fracturing (often termed ‘fracking’) as a means to extract shale gas can be managed effectively in the UK as long as operational best practices are implemented and enforced through regulation”*.
25. Both institutions concluded that *“more likely causes of possible environmental contamination include faulty wells, and leaks and spills associated with surface operations. Neither cause is unique to shale gas. Both are common to all oil and gas wells and extractive activities. Ensuring well integrity must remain the highest priority to prevent contamination”*.
26. That view is consistent with verbal advice received from Dr Rosemary Quinn, GNS Science, in November 2011. It is also consistent with the findings of the University of Texas, reported in Science Magazine²⁸ in February 2012: *“16 researchers ... in a variety of fields including air quality and hydrology ... did not see a need for new regulations specific to fracking, but for better enforcement of existing regulations of drilling in general - such as those covering well casing and disposal of wastewater from drilling”*.
27. To conclude this part of Straterra’s submission: public fears in New Zealand, and overseas, e.g., in Oklahoma²⁹, over the risk of fracking causing large earthquakes have had generally little or no basis in fact, and, furthermore, have appeared to persist without deviation, even when good information^{30,31} on fracking is readily available to anyone who wishes to read it.
28. Straterra concludes further that well casing integrity, and disposal of waste water are the key risks to the environment and human health posed by fracking, risks that are not unique to fracking, and risks which are amenable to being managed, within a risk management framework. We return to these two issues later in this submission, and continue now with further discussion on the nature of public concern over fracking.
29. A note on the application of fracking, for additional context: fracking can be used in standard petroleum extraction, i.e., natural flow from capped sandstone reservoirs, to improve the rate of, and total recovery from the well, as flow rates slow on approaching the recoverable maximum. That is the context for fracking to date in New Zealand –

²⁶ NZ Herald, 29 March 2012 http://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=10795201

²⁷ Shale Gas Extraction in the UK: a review of hydraulic fracturing, June 2012

http://royalsociety.org/uploadedFiles/Royal_Society_Content/policy/projects/shale-gas/2012-06-28-Shale-gas.pdf

²⁸ Science Magazine, 16 Feb 2012 <http://news.sciencemag.org/sciencenow/2012/02/mixed-verdict-on-fracking.html?ref=hp>

²⁹ Scientific American, 14 Nov 2011 <http://www.scientificamerican.com/article.cfm?id=did-fracking-cause-oklahomas-largest-recorded-earthquake>

³⁰ Baker Hughes white paper on fracking <http://www.nzpam.govt.nz/cms/pdf-library/folder.2007-05->

³¹ [_4547411750/Baker%20Hughes%20-%20hydraulic-fracturing-white-paper.pdf](http://www.halliburton.com/public/projects/pubsdata/Hydraulic_Fracturing/fracturing_101.html) Halliburton – Fracturing 101
http://www.halliburton.com/public/projects/pubsdata/Hydraulic_Fracturing/fracturing_101.html

as a way of stimulating a well whose performance is flagging. Taranaki Regional Council produced a report³² in November 2011, updated in February and May 2012, reviewing fracking operations in the region since 1989, covering 69 fracking events at 39 distinct wells.

30. The TRC report agrees with our view on the key issues to manage with fracking - well integrity and waste water management - and also identifies as risks, *“leakage through the geology overlying the hydrocarbon reservoir”*, and *“a well blowout resulting in underground leakage into aquifers or surface recharge via spillage”*. Leakage through the geology is addressed later in this submission, and the TRC report says the *“probability of a well blowout is very small, but cannot be completely discounted and has occurred during hydraulic fracturing operations in other countries”*. The only incident we are aware of in that connection occurred in Dimock, Pennsylvania, and is the only example we are aware of groundwater contamination as a result of fracking.
31. The fracking controversy – as we know it today - has arisen from the use of the technology to unlock natural gas from semi-impermeable rock formations, i.e., fine-grained, and usually deeply-buried, sedimentary rocks known as shale.

Sources of public concern – information is not wisdom

32. In July 2012 the Economist Magazine³³ summed up public concerns over fracking: *“In folklore the will-o’-the-wisp, a mysterious light that lures travellers away from paths into dangerous marshlands, was thought to be the embodiment of evil spirits. The light was probably methane, given off by rotting vegetation that had spontaneously ignited. The atavistic fear of gas lives on in public anxiety over fracking.”*
33. That article refers to the 2010 Gasland documentary, which, arguably, was the origin of the public concern over fracking worldwide. Spectacular scenes of residents setting fire to their tapwater captured the imagination of people around the globe. The fact is, however, that the methane in the drinking water, investigated by authorities at places such as in Fort Lupton, Colorado³⁴, turned out to have nothing to do with fracking. Rather, the seal of a water bore, driven through shallow coal seams, had corroded over time, and methane from the coal migrated into the tapwater.
34. It is noted that methane in groundwater is a common natural occurrence in New Zealand³⁵, including in areas where there has been no fracking.
35. That finding is consistent with a US Environmental Protection Agency study³⁶ published in 2004. The EPA is continuing to study³⁷ the impacts on groundwater and drinking water of fracking, and is due to publish its findings later in 2012.

³² Hydrogeological Risk Assessment of Hydraulic Fracturing for Gas Recovery, May 2012

<http://www.trc.govt.nz/assets/Publications/guidelines-procedures-and-publications/hydraulic-fracturing/hf-may2012-graph-p19.pdf>

³³ The Economist Magazine, 14 July 2012 <http://www.economist.com/node/21558458>

³⁴ COGIS complaint reports, 30 Sept 2008 http://cogcc.state.co.us/cogis/ComplaintReport.asp?doc_num=200190138

³⁵ e.g., State of the Environment: Groundwater Quality Technical Report, May 2010

<http://www.es.govt.nz/media/18168/soegroundwater-technical-report.pdf>

36. ³⁶³⁷ In relation to Gasland, the US gas industry³⁸ found a great deal more that was factually incorrect in the documentary, noting, for example, that in any one fracking operation around a dozen chemicals are used, not hundreds of chemicals, as Gasland documentary maker Josh Fox alleged. The documentary is riddled with this sort of basic mistake, which mars the good research that was done.
37. To digress briefly on the quality aspects of Gasland: the potentially dangerous, organic, volatile chemicals – BTEX - identified in Gasland as used in fracking in the US are, to the best of Straterra’s knowledge³⁹, not used today in New Zealand in fracking.
38. In the same vein, to return to Dimock, the scene of contamination of the water supply to 14 homes, of which much was made in Gasland. In the event, Cabot Oil & Gas Corporation settled with the State of Pennsylvania, to \$US4.6 million, in December 2010, and in August 2012 the Department of Environmental Protection cleared the way for Cabot to resume operations, subject to stringent pre-conditions being met⁴⁰.
39. Despite the shortcomings of Gasland, and notwithstanding the good points, a concerned public took to the documentary without question, and have built their world view of fracking around it, just as occurred with the report on the Blackpool earthquakes. That has led to numerous media reports making inaccurate claims about fracking, which Straterra has rebutted at intervals, e.g., in the NZ Herald⁴¹, and The Press⁴².
40. Other reports have also committed errors of fact or interpretation, and have compounded the confusion between information – or misinformation – and wisdom on fracking.
41. In Australia, the National Toxics Network⁴³ produced a damaging report on fracking chemicals, discussing chemicals not used in New Zealand, and saying, for example: “*BTEX chemicals are hazardous in the short term causing skin irritation, central nervous system problems (tiredness, dizziness, headache, loss of coordination) and effects on the respiratory system (eye and nose irritation). Prolonged exposure to these compounds can also negatively affect the functioning of the kidneys, liver and blood system.*”
42. Surely, that finding depends on the dosage experienced by a person exposed to BTEX chemicals. If the above conclusion were always the case, one would have to close all petrol stations because of the volatile fumes that attend current methods of pouring petrol into vehicles. Obviously, that will not be necessary, just as swimming pools do not need to be closed because of the presence of chloride chemicals that are potentially lethal to humans in their pure form.

³⁶ Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs Study, 2004 http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/wells_coalbedmethanestudy.cfm

³⁷ EPA’s study of hydraulic fracturing and its potential impact on drinking water resources <http://www.epa.gov/hfstudy/index.html>

³⁸ Debunking GasLand, June 2010 <http://www.energyindepth.org/debunking-gasland/>

³⁹ Straterra web pages on chemical additives used in fracking <http://www.straterra.co.nz/Fracking%20chemicals> and <http://www.straterra.co.nz/Chemical%20additives>

⁴⁰ The Times-Tribune, 22 Aug 2012 <http://thetimes-tribune.com/news/dep-lets-cabot-resume-dimock-fracking-1.1361871>

⁴¹ NZ Herald, 8 Aug 2011 http://www.nzherald.co.nz/opinion/news/article.cfm?c_id=466&objectid=10743590

⁴² The Press, 8 Aug 2011 <http://www.stuff.co.nz/the-press/opinion/perspective/5405729/Don-t-believe-fracking-scare-stories>

⁴³ Hydraulic fracturing in coal-seam gas mining, Sept 2010 <http://www.ntn.org.au/wp/wp-content/uploads/2012/04/NTN-CSG-Report-Sep-2011.pdf>

43. It is not Straterra’s intention to dissect and discredit every report, and media item, that has been produced that favours a negative view on fracking, in order to build a case for fracking. The point is that fracking is a complex topic, and misunderstanding can and does easily arise. As soon as the facts and an understanding of the facts are injected into the debate – we believe – public concerns ought to be allayed.
44. There is one report, and other research and media coverage that stems from it, or is related to it, that is worthy of mention, because it attracted attention in New Zealand, including on TV3’s 60 Minutes current affairs programme⁴⁴ (about which more will be said below).
45. This is the study⁴⁵ by Prof Avner Vengosh, of Duke University, and others published in the Proceedings of the National Academy of Sciences in April 2011. The authors documented “*systematic evidence for methane contamination of drinking water associated with shale-gas extraction*” in Pennsylvania and upstate New York. Subsequently Straterra discussed the findings with industry, and the alternative view is that this part of the US has been associated with petroleum development for more than 100 years, where all sorts of methods were used, that are no longer used. The PNAS study did not address that possibility. On the contrary, the PNAS study identified a lack of “*evidence for contamination of drinking-water samples with deep saline brines or fracturing fluids*”. That suggests strongly that fracking had nothing to do with the presence of methane in drinking water, or at least that there are a number of other explanations available to explain the observed contamination. Prof Vengosh later recanted⁴⁶.
46. The 60 Minutes item provided a reasonable, informative discussion on fracking, with the views of various sides of the debate presented. That said, there was also considerable innuendo, which requires rebuttal here. The image of a tank with the word “hydrocarbons” on it implied the use of organic volatile chemicals in fracking fluid in New Zealand, which are not used. The image of tapwater being set on fire from Gasland had nothing to do with fracking (para. 32); earthquakes in Ohio linked to fracking, of December 2011, were to do with injection of waste water underground⁴⁷, as part of the management of used water, and nothing to do with the fracking of rock formations per se; and four earthquakes⁴⁸ in Basel, Switzerland, in 2006 of magnitude 3.1 to 3.4 had to do with fracking for geothermal energy, not for petroleum, releasing more than 30 times the energy of seismicity associated with petroleum fracking. As stated in the preceding paragraph, Prof Vengosh et al’s findings concerning methane contamination of aquifers from fracking have been since retracted by Prof Vengosh.
47. To sheet home the point that there are at least two sides to the fracking story, one of them more closely connected to reality than the other, a report⁴⁹ published in April 2012 in the journal of the National Groundwater Association

⁴⁴ Avner Vengosh interviewed with others on TV3’s 60 Minutes, 18 Mar 2012 <http://ondemand.tv3.co.nz/60-Minutes-Meet-TheFrackers/tabid/59/articleID/5752/MCat/22/Default.aspx>

⁴⁵ Methane contamination of drinking water accompanying gas well drilling and hydraulic fracturing, 14 April 2011 <http://www.pnas.org/content/early/2011/05/02/1100682108>

⁴⁶ New York Times, 9 July 2012 <http://green.blogs.nytimes.com/2012/07/09/fracking-did-not-sully-aquifers-limited-study-finds/>

⁴⁷ Scientific American, 4 Jan 2012 <http://www.scientificamerican.com/article.cfm?id=ohio-earthquake-likely-caused-by-fracking>

⁴⁸ Huffington Post, 8 July 2012 http://www.huffingtonpost.com/2012/08/07/fracking-earthquake-conne_n_1752414.html

⁴⁹ Potential contaminant pathways from hydraulically fractured shale to aquifers, 17 April 2012 <http://onlinelibrary.wiley.com/doi/10.1111/j.1745-6584.2012.00933.x/abstract>

of the US, written by Tom Myers, a consultant from Reno, Nevada, concluded

via computer modelling that fracking fluids and hydrocarbons could migrate upwards into aquifers within a few years of fracking occurring. If so, that would be worrying indeed.

48. A month later this thesis was refuted by Prof Don Siegel, Syracuse University, New York State, who argued⁵⁰ that: Mr Myers used the wrong permeability for overlying rock in his model; wrongly assumed that artesian pressure operates in Appalachian groundwater systems; and wrongly assumed that fractures in rock at or near the surface extend down to the depths of gas-bearing shale. It is also noted that Mr Myers' research was part-funded by the Catskill Mountainkeepers, an environmental group who are opposed to fracking.

49. As noted in para. 11, we found only one instance of less than ideal reporting on fracking from the positive perspective, and that related to the Dimock incidences of drinking water supply contamination. In the Shale Oil Shock, it was reported in connection with the settlement reached that: "Cabot maintains that it was not the cause of gas contamination". We believe that it is not good enough to acquit the company in this way without stating the evidence in favour of Cabot's culpability. But that is a small departure from the otherwise very high standard of this report, we suggest.

Calls for moratoria are largely politically and ideologically motivated

50. The 60 Minutes item noted moratoria on fracking in various parts of the world, including France, Bulgaria, and parts of the US, and of Australia. A 14-month moratorium in South Africa ended in September 2012, amid controversy⁵¹.

51. Calls are regularly made for moratoria on fracking in other countries, e.g., in the UK, by the UK Green Party and others, who have accused Cuadrilla Resources, the Lancashire fracking company mentioned earlier, of being "*unwilling to respect even the most basic safeguards in the earliest stages of exploration*"⁵², to underpin their argument. The rest of The Guardian news item explains, however, that the alleged breach of conditions relate to a ban on operations during the wintering-over period of some bird species. Regardless of whether or not a breach occurred in this case, it has nothing to do with fracking per se.

52. From the material presented thus far, Straterra has come to the view that the various moratoria in existence have arisen largely as a result of politically or ideologically-motivated campaigns, mired in confusion, misunderstanding, and misinformation. There is a second reason: that it is possible that in some or many countries, there is very little regulation of fracking, an understandable and valid cause for concern.

53. An appropriate response from government to vocal public pressure to stop an activity that industry defends, where there is perceived to be inadequate regulation, is to investigate the evidence, as the Department of Environmental

⁵⁰ Errors in Myers' Marcellus Shale Groundwater Paper from Start to Finish, 13 May 2012

<http://eidmarcellus.org/marcellusshale/errors-in-myers-marcellus-shale-groundwater-paper-from-start-to-finish/8761/>

⁵¹ Post, 8 Sept 2012 <http://www.thepost.co.za/sa-split-as-moratorium-dropped-1.1378517>

⁵² The Guardian, 10 Sept 2012 <http://www.guardian.co.uk/environment/2012/sep/10/cuadrilla-breach-fracking-lancashire>

Conservation⁵³ has been doing in New York State, and as is occurring in the Australian State of Victoria⁵⁴. It is noted that public support of fracking in the US has been gradually increasing over time as more information comes to light⁵⁵.

54. In the case of New Zealand, Straterra believes it is appropriate for the PCE to conduct an investigation, while not imposing a national moratorium. There are three compelling reasons for this, in our mind. We are entitled to give industry the benefit of the doubt, because of good performance to date; we recognise the existence of comprehensive resource management legislation in our country; and we have argued the case for healthy scepticism of the advocacy advanced by those who oppose fracking.

Risk management in relation to fracking

55. It is accepted that the various reports and media coverage on fracking do raise legitimate concerns over regulation, and, specifically, around the integrity of the casings used to line petroleum wells, and, indirectly, around practices for the disposal of waste water, brine, or produced water. To these issues, we now turn, though briefly, noting that these matters will have been addressed in detail by other submitters to this investigation.

Irrelevant considerations

56. We begin with a list of the issues that present little or no risk in relation to fracking, or those that Straterra considers are irrelevant for the purpose of the PCE investigation.

57. Fracking uses a substantial amount of water, however, that is also the case for many other uses of water, e.g., pulp and paper mills, food processing, pastoral farming and horticulture. The Government is working to improve the governance and management of freshwater in New Zealand⁵⁶, and in that context, fracking is a use of water that would be managed like any other.

58. Fracking will most likely lead to more gas produced and used in New Zealand, which raises issues to do with New Zealand's greenhouse gas emissions, while improving the security and affordability of New Zealand's energy supply. In any event, the climate change issue is addressed within a specific legislative framework, namely the Climate Change Response Act 2002. On that basis, this issue is an irrelevant consideration, while noting that fracking for gas would be consistent with an energy transition to a lower-carbon economy.

59. Similar arguments apply to concerns over the large numbers of trucks using roads associated with fracking, and the effects on landscapes of fracking. Suffice to say that fracking companies would develop road-use plans with councils, and, in New Zealand's climate and patterns of existing land-use, fracking operations would be barely visible from the ground if at all. In addition, these types of effects may be assessed in the context of district plan provisions and land-use consent applications.

⁵³ The Huffington Post, 9 June 2012 http://www.huffingtonpost.com/2012/09/06/new-york-fracking-decision_n_1862112.html

⁵⁴ The Age, 25 Aug 2012 <http://www.theage.com.au/victoria/state-bans-fracking-20120824-24sgm.html>

⁵⁵ Bloomberg, 28 Sept 2012 <http://www.bloomberg.com/news/2012-09-28/support-slips-for-more-rules-as-gas-frackerscampaign.html>

⁵⁶ Ministry for the Environment <http://www.mfe.govt.nz/issues/water/freshwater/fresh-start-for-fresh-water/>

60. The possibility of fracking fluids and petroleum migrating from a fracked formation upwards into the water table must be considered extremely remote, as discussed in paras. 45-48. Fracking is only cost-effective if the target rock is more brittle than the surrounding rock, as representatives of TAG Oil/Apache⁵⁷ told a briefing convened in Wellington by New Zealand Petroleum & Minerals on 9 December 2011. In that scenario, the fissures produced during fracking do not, and cannot migrate into the more elastic rock above it, and that is often the case with impermeable caprock, having a finer grain size than the oil or gas-bearing shale rock. Of course, monitoring of the geology would be carried out, before, during and post fracking, to test that requirement against the reality. One indication of cracks migrating beyond the target formation would be a loss in down-hole pressure, an easily determined and immediate signal to stop the operation.
61. The link to earthquakes or seismic activity has been addressed extensively in this submission. A number of other concerns are covered in Straterra's Frequently Asked Questions section on our web site⁵⁸.

Well casing integrity

62. That leads to well casing integrity and management of waste water, which are issues common to all petroleum development. The following discussion has been informed by numerous discussions with industry, in particular with companies that actually do fracking. We have provided this text for completeness, noting that industry submitters will have entered into the necessary detail. (The disclaimer is that Straterra staff are not experts in the field.)
63. We understand that it is possible that a failure in the concentric steel and cement casings of a well could lead to fluids within the well bore migrating into an aquifer. That is particularly the case if these fluids are under pressure, as would be the case during a fracking operation, and is a risk the fracking industry must manage.
64. Several things could happen by way of risk management. One is to install three sets of concentric and alternating well casings of steel and cement down to a safe depth below the water table. Another is to use remote sensing equipment to demonstrate 100% well integrity, measured at regular intervals. While nothing can ever be guaranteed to 100% accuracy, the analogy would be that a bicycle tyre either has a leak or it does not, and that the distinction between one or the other situation is easily established. A further measure is to have an automatic shut-down system if there is any measured loss of pressure in the well during fracking. Should the automatic system fail, there would be a manual system. Once the well has come to the end of its life, the well would be abandoned properly, e.g., by inserting a column of cement or other material of an appropriate chemical composition and physical characteristics to fill the well. The broader point is that this is a well-recognised risk, and consents should require a satisfactory management and mitigation plan.
65. All of the above measures would form part of a risk management plan or similar document developed with the local council, as part of the regulatory conditions imposed on any fracking operation. That is at it should be for

⁵⁷ TAG Oil/Apache web pages <http://www.tagoil.com/20110902-TAG%20Enters%20Into%20Farmout%20Agreement%20with%20Apache%20Corporation.asp>

⁵⁸ FAQs on fracking <http://www.straterra.co.nz/FAQs>

fracking, or, indeed for any engineering operation of reasonable complexity, including the construction of bridges, tunnels, hydro dams, and geothermal energy facilities.

Management of water

66. That brings us to the management of used water or produced water. Much has been made of the chemical additives used in fracking, and of the apparent secrecy of companies who use these fluids. For our part, Straterra has had no difficulty in ascertaining the sorts of chemicals that are used in fracking in New Zealand, and examples are provided in our web pages⁵⁹. These chemicals would be regulated in any event under the Hazardous Substances and New Organisms Act 1996, e.g., in relation to their transport, storage on site, and handling. The Health and Safety in Employment Act 1992 also applies.
67. Water that comes back up a fracked well is collected normally in lined ponds⁶⁰, sumps or storage tanks. In the concentrations the chemical additives are used, this water is not toxic, although it would be unpleasant to drink. This water is either treated chemically or mechanically to meet specified levels of purity, or diluted to reduce concentrations to below council threshold requirements.
68. The water can then either be re-injected to deep formations (via a well where deep formations are isolated from shallow aquifers), which would occur under pressure and is costly, or the water could be discharged into rivers under a resource consent, or there could be a requirement for disposal at other sites, e.g., onto farmland. That water could also be delivered to a contractor that specialises in the appropriate and lawful management of water discharges. It depends on what the council requires, under the Resource Management Act 1991, and, for any use of land, landowner consent would be also required.
69. As to the well sites themselves, various consents are required for their construction, including a requirement for containment of surface run-off of water. Skimmer pits and drainage systems provide for surface run-off to flow through the system, to be trapped and cleaned before this water disperses beyond the site, a more stringent requirement than construction sites, generally, where only silt and sediment traps are required.
70. The controversy in relation to regulation in New Zealand – we believe – is twofold. There is a perception that it is the injection or re-injection of fluids underground that is unregulated. This is covered, however, under section 15 of the RMA, and Taranaki Regional Council has been writing guidelines and other material to clarify the matter⁶¹. According to New Zealand Petroleum & Minerals⁶², the TRC approach is being socialised with other councils, which is all to the good, with emphasis on meeting the sorts of standards promulgated by the American Petroleum Institute⁶³.

⁵⁹ Straterra web pages on chemical additives <http://www.straterra.co.nz/Chemical%20additives>

⁶⁰ Note the discussion between Gareth Hughes MP, and Hon Phil Heatley in Parliament, 25 Sept 2012 http://www.parliament.nz/en/NZ/PB/Business/QOA/0/7/d/50HansQ_20120925_00000008-8-Oil-and-Gas-Extraction-Hydraulic-Fracturing.htm

⁶¹ Taranaki Daily News, 25 April 2012 <http://www.stuff.co.nz/taranaki-daily-news/news/6802689/Consent-given-for-fracking>

⁶² NZP&M information on fracking <http://www.nzpam.govt.nz/cms/petroleum/overview/frequently-asked-questions-aboutfracking#whatstandards>

71. The other issue is ongoing concerns in relation to practices for disposal of waste water. In part, these fears have been inspired by an event⁶⁴ in 2009 at Dunkard Creek, on the border of Pennsylvania and West Virginia, in which an algal bloom killed a wide range of freshwater species. The algal bloom, in turn was caused by a discharge to water, either from a coal mine, or a fracking operation or both. If this event was caused by fracking, this is an issue to do with unregulated discharge of waste water. In New Zealand, we are safe from such practices. Section 15 of the RMA prohibits any discharge to water or land – in circumstances where it may enter water – unless expressly allowed by a relevant instrument. If consent is obtained and a breach occurs, there are enforcement procedures for addressing that. If a failure in enforcement occurs, that is a failure of the council, not of the law.

Conclusions

72. Straterra contends that fracking is acceptable from an environment, and human health perspective, because the risks are amenable to management.
73. Fracking is an important technology for unlocking gas resources tightly held in reservoir rocks. It also offers a path for New Zealand's energy transition to a lower-carbon economy.
74. In Straterra's view, the excellent report by the Royal Society and the Royal Academy of Engineering in the UK on fracking (paras. 24-25), lays the controversy over fracking to rest.
75. Nonetheless, opponents to fracking have created a furore over fracking, in which very little in the way of facts or understanding of the facts have been presented. Their relative success to date – notably, the moratoria on fracking in Christchurch and Dunedin – is nothing to celebrate, and, indeed, should be of concern to all New Zealanders.
76. Much of that concern has stemmed from overseas reports that are flawed, or have been interpreted selectively or incorrectly, to build a case against fracking.
77. That said, there are legitimate concerns to do with the regulation of fracking. This is a field worthy of further study, if only to make the experience of Taranaki Regional Council more widely known, improved on if necessary, and practised in New Zealand.
78. In particular, well integrity and management of water discharges are the key risks that must be managed in fracking, issues common to all petroleum development. Managed properly, the effects of these activities are no more than minor, and should be either permitted subject to standard conditions, or approved under non-notified resource consents, with appropriate conditions, including risk management, and monitoring, evaluation, and reporting.

⁶³ American Petroleum Institute standards for fracking

http://www.api.org/~media/Files/Policy/Exploration/Hydraulic_Fracturing_InfoSheet.ashx

⁶⁴ New York Times, 12 Oct 2011 <http://www.nytimes.com/gwire/2011/10/12/12greenwire-in-fish-kill-mystery-epa-scientist-points-at-s-86563.html?pagewanted=all>

79. The PCE has an important role to play in investigating hydraulic fracturing in New Zealand. Straterra looks forward to a carefully considered, well informed, and evidence-based report.

Yours sincerely,

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