

**Submission to:**  
**WA Scientific Inquiry into Hydraulic Fracture Stimulation in WA 2017-2018**

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My name is Juanita Farley and I make this submission on behalf of myself, my three young children and my parents. I am a qualified teacher whilst my parents are retired and, as concerned members of community, we are motivated to make this submission particularly in relation to the health, wellbeing and future of my children.

We do not have personal experience of unconventional gas mining however have for the past two or more years been researching the industry and hydraulic fracture stimulation. Seeing John Fenton from Pavilion, Wyoming in USA, who has several wells on his property and hearing of the damaging effects on his family's health, wellbeing, and their quality of life prompted me to investigate this industry further. Mr Fenton was very genuine in his explanation and photos depicting the problems with their water supply, the challenges of wells operating very close to their home, the need to have windows open whilst having a shower or running water, the animal health issues.

My main concern is that our Moora town water supply may become contaminated, the air polluted by both drilling activities and noise and light, particularly if drilling is carried out on the town edge which is under Permit. This would affect me and my children and takes away our basic human right to clean air and water.

Information is obtained with ongoing research by our local group against Fracking, and our own personal searching to keep up to date. I therefore wish to make my submission today on Misconceptions, Myths, Claims and the Realities in the Gas and Oil Industry.

## **MISCONCEPTIONS**

The public and probably Government understanding of the word "fracking" is that it covers the whole industry in relation to unconventional gas exploration and production as well as the hydraulic fracture stimulation of conventional wells which have slowed down in production. The gas and oil industry however conveniently refer to fracking as being the actual physical act of hydraulic fracture stimulation regardless of all other activities carried on in the process of extracting gas and oil.

This conveniently is regularly used by the industry to counter challenges regarding certain activities, by claiming that fracking is safe.

## **MYTHS**

There are many statements made about and by the whole oil and gas industry which have been counter-claimed as being myths. I shall touch on only a few of these.

- **Gas/oil production creates large financial benefits to the Country and to the State.** This is not so as concessions and rebates mean that industry is very unlikely to ever pay much in the way of royalties to the Government, Federal or State, because by the time the concessions and rebates expire, production will be on the way out. And with 83% of ownership of exploration companies being foreign, nearly all profits immediately leave the country. From the point of view of landholders, this is not a case of "we have struck oil and will be millionaires" – with no royalties payable to landholders, they receive only a pittance for the occupancy of their land, probably denigrated in the process.

- **Gas and oil production creates large numbers of jobs** – the total mining industry, not just oil and gas, employs only 2% of population and for every 10 mining jobs created, it has been found that 18 agricultural jobs were lost.
- **Natural gas is a clean form of energy.** Not so – measurements are taken in the final burning process, not during the extraction process which creates loss of large amounts of methane and other emissions into the atmosphere.
- **Mining for gas/oil is safe, the risks can be managed and has been carried out safely for years in SA, Qld, WA, NSW and Victoria.** The ongoing spills, leaks and accidents speak for themselves, often not reported unless discovered by a third party.
- **There is a shortage of gas in the Eastern States** – there is no shortage, just that most is exported leaving locals paying higher prices for their gas because demand is higher than the volume available after export gas is sold at cheaper prices than the locals are paying.

## CLAIMS

- **The industry is transparent.** It doesn't take much to find evidence that this transparency is not so, with half truths, omissions, misrepresentations and quotes taken out of context abounding. As was noted recently when talking about leaks and spills – “not recorded”, “not reported” or “not noted” doesn't necessarily mean nothing happened.
- **Unconventional gas will not contaminate aquifers because the wells go way below them and they are protected by the well structure and the impermeable rock layers between.** The explanation of Dr Anthony Ingraffea below talks about the fissures which already exist in the rock and are made larger by the process of fracking. How then can it be claimed that there is no risk to the aquifers if there are already fissures all through the rock? Of course gas can leak upwards to the aquifers. **(See below)**
- **There is minimal risk in gas/oil extraction using modern methods and “best practice management”.** There is still always a large risk and any risk to health and wellbeing should not be considered acceptable. No amount of “best practice management” will prevent accidents and natural extreme weather events.
- **There is no evidence that mining is affecting health.** Not so! There is now ever-mounting evidence of extreme health issues to both humans and animals including farm stock as a result of proximity to drilling activities.
- **That mining does not affect landholders continuing with normal farming activities.** This is also incorrect. There is strong evidence of pipelines, roads, traffic, weed contamination, gates being left open, stock getting caught up in drainage areas, but with confidentiality agreements compulsorily signed by landholders, we don't very often get to hear of or see the real problems.
- **That cattle cause production of more methane gas than unconventional gas activities** – also not so. Studies show that livestock are a part of a closed atmospheric carbon cycle where the methane they emit is equal to the carbon they take in. **David Mason-Jones in “Should Meat Be on the Menu?”**
- **The technology has been used for decades** – the current technology was only developed in 2006-2007 as confirmed by Dr Anthony Ingraffea – **see below.**
- **Around 700 wells have been fracked in WA (including showing on AWE website Q&A)** – DMP figures show that 563 wells on Barrow Island have since 1965 been fracked with low pressure to stimulate failing quantities of oil and gas, and of the 25 other wells fracked in total, only 8 have been

fracked since 2008 so could have been the only ones fracked with modern methods. (see DMP – WA Well Stimulation – Well List)<sup>1</sup>

- **That seismic testing and fracking activities have no bearing on earthquake activity.** Although hundreds of earthquakes have now been proven to be fracking activity induced, there is still insufficient evidence to prove that the current spate of earthquakes round the world, including WA, has anything to do with fracking. However, it does seem unusual that earthquake activity has increased in leaps and bounds in the past 10 years or so.
- **Areas of bush cleared for seismic testing or drilling will be rehabilitated upon completion.** Unfortunately this rehabilitation doesn't happen in 1 year or even 5 years. And with declining rainfall in many areas, unless watered regularly, many of the replants will not even survive.
- **Unconventional gas will revive ailing rural economies.** In Queensland and in Taranaki, New Zealand, this has proved the exact opposite. In Midland Texas, the businesses which had built up because of the requirements of the mining boom, now find that customers are disappearing fast as shown in the article: *"In World's Hottest Oil Patch, Jitters Mount That a Bust Is Near"*<sup>2</sup>

## REALITIES

- Damage to roads.
- Accidents involving trucks carting chemicals and millions of litres of chemically laced wastewater for disposal.
- Industrialisation of former prime productive land.
- Water depletion in already water-poor communities.
- Insufficient water available for full farming/horticultural production without use for fracking.
- Although methane is said to be non-toxic in groundwater, Dr Mudd in the Northern Territory claims that "if we start to introduce a sufficient amount of methane into billabongs and wetlands, we are at risk of changing some aerobic wetlands into potentially anaerobic, and that's a very serious issue."
- Video "Fracking – an Inconvenient Truth" - <https://www.youtube.com/watch?v=uokmsSi7LTY> (35.34 minutes)
- Video presentation by Dr GERALYN McCARRON of Doctors for the Environment to the Australian Tribunal into the Human Rights Impacts from Unconventional Gas – in which she quotes various health issues and problems in Queensland which are being ignored. (13.29 minutes)  
[https://www.youtube.com/watch?time\\_continue=55&v=4FRFuHWPcTg](https://www.youtube.com/watch?time_continue=55&v=4FRFuHWPcTg)
- Doctors for the Environment submissions to the Northern Territory Inquiry:

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<sup>1</sup> [dmp-search.clients.funnelback.com/s/redirect?collection=dmp-meta&url=http%3A%2F%2Fwww.dmp.wa.gov.au%2FDocuments%2FPetroleum%2FPD-SBD-NST-126D.pdf&index\\_url=http%3A%2F%2Fwww.dmp.wa.gov.au%2FDocuments%2FPetroleum%2FPD-SBD-NST-126D.pdf&auth=UjNvBFGlkr6uWfM2F%2BVh4g&profile=\\_default&rank=1&query=wells+fracked](http://dmp-search.clients.funnelback.com/s/redirect?collection=dmp-meta&url=http%3A%2F%2Fwww.dmp.wa.gov.au%2FDocuments%2FPetroleum%2FPD-SBD-NST-126D.pdf&index_url=http%3A%2F%2Fwww.dmp.wa.gov.au%2FDocuments%2FPetroleum%2FPD-SBD-NST-126D.pdf&auth=UjNvBFGlkr6uWfM2F%2BVh4g&profile=_default&rank=1&query=wells+fracked)

<sup>2</sup> <https://www.bloomberg.com/news/features/2017-09-25/in-world-s-hottest-oil-patch-jitters-mount-that-a-bust-is-near>

- Submission to the Scientific Inquiry into Hydraulic Fracturing in the Northern Territory - April 2017  
<https://www.dea.org.au/wp-content/uploads/2017/04/Scientific-Inquiry-into-Hydraulic-Fracturing-in-the-NT-Submission-04-17.pdf>
- Submission to the senate enquiry into the governance and operation of the Northern Australia Infrastructure Facility July 2017  
<https://www.dea.org.au/wp-content/uploads/2017/08/Governance-and-operation-of-NAIF-Submission-07-17.pdf>
- Further information to the NT inquiry  
<https://www.dea.org.au/further-information-to-the-scientific-inquiry-into-hydraulic-fracturing-in-the-northern-territory/>
- Supplementary submission October 2017  
<https://www.dea.org.au/wp-content/uploads/2017/10/Supplementary-Submission-to-the-Scientific-Inquiry-into-Hydraulic-Fracturing-in-the-NT-10-17.pdf>
- February 2018 Submission in response to the Draft Final Report :  
<https://www.dea.org.au/wp-content/uploads/2018/02/Scientific-Inquiry-into-Hydraulic-Fracturing-in-the-NT-02-18.pdf>
- **Dr Anthony Ingraffea** – Dr Ingraffea was one of the pioneer researchers in the development of fracking but has now changed to campaigning against its use. He was interviewed by Ellen Cantarow and because the information and clarity is extremely important, I am including most of the interview in this submission. The full interview can however be obtained at:

<https://resize.rbl.ms/simage/https%3A%2F%2Fassets.rbl.ms%2F6433934%2Forigin.jpg/1200%2C859/SBvqW8DqEmty8Rgc/img.jpg>

plus there are many YouTube videos of speeches and interviews available.

### **Ellen Cantarow interviewing Dr. Anthony Ingraffea says:**

Why, exactly, is [high-volume slickwater hydraulic fracturing](#) such a devastating industry? How best to describe its singularity—its vastness, its difference from other industries and its threat to the planet?

When I interviewed Dr. Anthony Ingraffea—Dwight C. Baum Professor of Engineering, Weiss Presidential Teaching Fellow at Cornell University and president of [Physicians, Scientists and Engineers for Healthy Energy, Inc.](#)—I realized that his comments were perhaps the clearest, most compactly instructive of any I'd heard on fracking. So I expanded the original interview to include Ingraffea's reflections on his odyssey from an industry insider to an implacable fracking opponent, with his descriptions of the fascinating nature of 400 million-year-old shale formations and what, precisely, corporations do when they disrupt these creations of nature.

Ingraffea is perhaps best-known for his co-authorship of a Cornell University 2011 study that established the greenhouse gas footprint of fracking as being greater than that of any other fossil fuel including coal. The lead-investigator for [Methane and the Greenhouse-Gas Footprint of Natural Gas from Shale Formations](#), often called “The Cornell Study,” was Robert Howarth, David R. Atkinson Professor of Ecology and Microbiology. A third co-author was research aide Renee Santoro.

Ingraffea has been a [principal investigator on research and development projects](#) ranging from the National Science Foundation, National Aeronautics and Space Administration (NASA) through

Schlumberger, Gas Research Institute, Sandia National Laboratories, Association of Iron and Steel Engineers, General Dynamics, Boeing and Northrop Grumman Aerospace. Having been an industry insider for so long, he's a formidable opponent of anyone who dares to go against him in a debate about high-volume hydraulic fracturing.

His passion for social justice has infused his teaching. He has promoted the entry of women and minorities into engineering. Among his teaching awards are the Society of Women Engineers' Professor of the Year Award in 1997 and the 2001 Daniel Luzar '29 Excellence in Teaching Award from the College of Engineering. He organized and directed the Synthesis National Engineering Education Coalition. Its mission: improving undergraduate engineering education and attracting larger numbers of women and minorities to the field.

Those who have watched Ingraffea in action know him for his simplicity and clarity, his refusal to indict his opponents on any but rigorous scientific grounds, the logic with which he demolishes them and his sense of humor. Several years ago, towards the end of a long talk in Pennsylvania Ingraffea mentioned that on Halliburton Corporation's website the corporation lists hydrochloric acid (HCl) among its fracking chemicals. Halliburton also notes that HCl is commonly used in preparing black olives.

Ingraffea deadpans: "It's really nice to know that," he says. He waits a few seconds for his audience's response (laughter). Under a crown of white hair he has expressive black eyebrows and a face straight from Sicily. That face now appeals to his audience with puckish bewilderment.

"So am I now supposed to be less fearful of black olives?" Pause, laughter. "Or more fearful of the hydrochloric acid used in the frack?"

He smiles, shakes his head and makes a what-can-you-do gesture with his hands. "I don't know what the point is. Obviously, using 50 thousand gallons of hydrochloric acid, and it has to be brought by truck, and stored on the site, and it's injected [without being] diluted ... 'cause it has to go in there and do a job, which is dilute all the crap in the perforations [of the shale]. So to tell me it's also in black olives doesn't inform me. It irritates me." Pause, more laughter. "And I'm gonna continue to eat black olives, the passion fruit of the Sicilians."

### **Q. Could you talk about your earlier career and how you came to your current views?**

**A.** I started out to be an astronaut, with a BS in Aerospace Engineering from Notre Dame, and a few years at Grumman Aerospace Corporation. Things happened, the Vietnam war, the first energy crisis, deciding on an academic career, and I started to study rock mechanics in 1974 at U of Colorado/Boulder. My doctoral thesis was on crack propagation in rock. Not many of us entered that field, but with that first energy crisis, it was analogous to the "going to the moon" challenge: how to get more energy [fossil fuels] out of rock. I started research on that topic for the NSF [National Science Foundation] and DOE [Department of Energy] in 1978, and began receiving research funding and consulting support from the oil and gas industry in 1980. That industry support continued through 2003, with much of it coming from the Gas Research Institute (now called the [Gas Technology Institute](#)) and [Schlumberger](#).

The work with Schlumberger focused on various aspects of hydraulic fracturing. The only contact I ever had with shale gas development was 1983-1984. I spent my first sabbatical at the Lawrence Livermore National Lab working on what was then called the Department of Energy's Eastern Devonian Shale Project. We were using computer simulation to try to understand how to fracture already fractured shale. [Shale already has natural fractures: see Ingraffea's comments below.] But it turned out to be a dead end, nobody knew how to do it, it looked like an insoluble problem.

### **HOW FRANKENSTEIN GREW**

Fractures in the shale happened naturally, millions of years ago. And that natural fracture network is essential to “fracking.” If the rock hadn’t been fractured by nature, humans couldn’t “frack” it—re-frack it—effectively. But since it’s already naturally fractured, there’s no way humans can know where the fluid will go. There’s a branch of mathematics called nonlinear chaos that applies here, meaning the slightest change in conditions and you get a tremendous change in outcome.

It wasn’t until 2007 or 08 that I found that somebody had figured out how to do it. I was aghast at what the solution was: high-volume, slickwater fracking from multi-well, clustered pads with very long laterals. It was as if [I’d] been working on something [my] whole life and somebody comes and turns it into Frankenstein.

**Q. Could you explain laterals?**

**A.** The lateral is the part of the well that is not vertical. It’s the part that snakes through the shale layer in whatever direction that takes.

**Q. And slickwater?**

**A.** That’s the name given to the fracking fluid. It’s been laced with a lubricant because contrary to what you’d think, water isn’t slippery or viscous enough to do the job.

**Q. Could we backtrack to earlier fracking? Was there only one well?**

**A.** Yes. In so-called conventional fracking for natural gas, there is only one well per pad. That’s because one is hoping to intersect a large, concentrated volume of gas, a trapped bubble if you will. This is not the case in unconventional shale gas, where the gas is distributed, not concentrated, so one needs to drill virtually everywhere with many pads and many wells per pad.

**Q. What’s a "pad?" Is it cement?**

**A.** [laughs] No, it just refers to an area. The pad is the area the operator uses or requires to do all of the operations of drilling and fracking and storage, and freshwater and wastewater containment.



This image above of fracking in America gives a good indication of the extent of fracking—four oil pads every square kilometer.

If you look at aerial photographs, everything you see—all the drilling rigs and trucks and tanks and the little ponds—that’s a "pad." And of course multi-wells mean a lot of wells in the area, and you see a clustered pad arrangement when you fly over an area of a state and you see pads put down in a

regular grid pattern. There will be a pad every one mile north, one mile south, one mile east, one mile west. When I talk to the public who are not familiar with this, the part of the process they have most difficulty with isn't the fracking—going down vertically and then turning—the thing they have most difficulty with is this clustered pad arrangement.

Modern shale gas development is, in my opinion, reversing what nature has done over the last 400 million years or so. In shale gas development we're releasing carbon that nature stored for all that time. For 400 million years nature has been storing carbon underground and in water, in the oceans. And now humans are coming along and releasing the carbon and in the process we have to take fresh water off the surface of the earth and sequester it underground. And we get it out by pumping water down. This is at a time in human existence when global warming from excess carbon dioxide and methane and water shortages are problems worldwide. To me that is Frankensteinian—a devilish, deadly process.

### **Q. What do you think is most dangerous about fracking?**

**A.** The problem is not “fracking.” The oil and gas industry has made hay out of the word “fracking” to redefine the issue. They say, “we’ve been doing this for 60 years and there’s never been a documented case ...”

[“Fracking”] is a relatively brief period of time in the life cycle of an enormous industry when [water](#) laced with [sand](#) and [chemicals](#) is pumped down wellbores and the shale is re-fractured. That’s when something very, very distant from people happens. It takes months, maybe years to completely develop a modern shale gas pad. It might take months to process and transport the methane to a market. The fracking process takes a few hours per well..

People against fracking don’t think of everything that happens before and after. That’s much more risky to human health and the environment. The highest risk to water is when the fracking chemicals are on the surface being stored and being pumped down for fracking, and when they and the harmful materials that had been sequestered in the shale return to the surface after fracking in what is called flowback fluid.

Fracking per se presents little risk to air quality, but the air pollutants from diesel engine exhaust and methane emissions associated with the processes of excavation, drilling, dehumidification, compression, processing and pipeline transport do present serious problems with air quality and global warming. The single most significant element of shale gas development that seems to just not be understood by many is its spatial intensity. It is an extreme form of fossil fuel development because of the very large number of very big wells, total vertical and lateral length and volume of the frack fluid, that have to be drilled throughout a shale play [“play” is the engineering and industry term for “formation.”]

### **VANISHING LANDSCAPES, POISONED AIR**

So what do I think is the largest threat to humans posed by the unconventional development of natural gas from shale formations around the world? And if I wanted to be more specific as an engineer, strictly speaking, what is the greatest threat from clustered multi-well pads, using high-volume hydraulic fracturing from long laterals? That’s the problem.

Because it’s a spatially intense, heavy industrial activity which involves far more than drill-the-well-frack-the-well-connect-the-pipeline-and-go-away, it results in much more land clearing, much more devastation of forests and fields. There’s the necessity of building thousands of miles of pipelines which again results in destruction of forests and fields. There’s the construction of many compressor stations, industrial facilities that compress the gas for transport through pipelines and burn enormous quantities of diesel. [They make] very loud noise and emit hydrocarbons into the atmosphere. Then,

there's the necessary construction of waste pits, and fresh-water ponds which again require heavy earth movement, heavy construction equipment, the off-gassing of waste products from the waste pits, and tremendous amount of heavy truck traffic which again results in burning of large quantities of diesel, increased damage to roads, bridges and increased risk to civilian transportation in the midst of the traffic.

## **AN INDUSTRY WITHOUT BOUNDARIES**

For just about every other industry I can imagine, from making paint, building a toaster, building an automobile, those traditional kinds of industry occur in a zoned industrial area, inside of buildings, separated from home and farm, separated from schools. We have been wise enough because of the way we civilized ourselves to realize that heavy industry should be confined to enclosed spaces. Contrast that here: we have been told by the oil and gas industry that our homes, our schools, our hospitals even, if they are in zoned areas for residences, have to become part of their industry. Oil and gas law in most states trumps zoning. It permits the oil and gas industries to establish its industry next to where we live. We're asked to participate inside their spaces. They are imposing on us the requirement to locate our homes, hospitals and schools inside their industrial space.

### **Q. When and how did you start educating people about the threat of the industry?**

**A.** Two things happened. About four years ago, when the shale gas business heated up in NY, I became aware of advertisements on the radio, on TV, in newspapers, articles written in the print media, letters to the editor, op eds, all the way from the *New York Times* to local papers. And what I'd been reading was astoundingly inaccurate. And if not inaccurate, off-target, incomplete. So my first reaction as an engineer was, they're not telling the whole truth, they're missing the main points.

I was asked by some of my fishing buddies—fishermen have a vested interest in clean water by the way—they asked me to give a talk to the local chapter of Trout Unlimited. That's how I got started on the public circuit. And that caused me to dive more deeply into the literature at the time, the petroleum and engineering literature, and that's when I began to understand shale-gas development.

### **Q. So could you comment on several areas where you think the dangers lie?**

**A.** People's water wells have been contaminated at a significant rate. The industry would say, "When we drill wells some of the wells leak, but it only happens rarely." I would counter: it used to happen only rarely, now it happens more frequently.

There's the global threat of [global warming](#), there's the local threat of contamination of water wells, and there's the regional threat of air contamination, and surface and groundwater contamination which are exacerbated by the spatially intense form of extraction. Because you have multi-well pads and clustered pads you have very big industrial operations with diesel engines operating for long periods of time in large regions, smog, ozone creation at regional levels.

There are air quality problems because of the nature of shale gas development. Also water quality problems at the regional level because of accidents or purposely dumping of waste in surface waters.

People need to breathe air. People need to drink water. People need to live in an acceptable climate, one they can expect will be stable and unchanging. There are two things involved. Having the community you wanted to live in and you've lived in your whole life just taken over from you, and the environment, the water, the air, the climate, the flora the fauna, it's all under threat. Both of those threats reside on the spectrum of health versus wealth. It's the health of many versus the wealth of few.

**Q. So are you for banning this industry?**

**A.** My position is this. Where shale gas development has not yet occurred, ban it. Period. Where it is occurring, enact ironclad regulations, inspect for compliance with them with dogged diligence, and enforce them relentlessly with fines that really mean something. The Ten Commandments are “regulations,” but as words alone where do they leave us?

**THE TRANSITION TO SUSTAINABLE ENERGY**

Finally, wherever any [fossil fuel](#) is being developed, slow down its production and use as quickly as feasible, considering all facets of this very complex problem. You can’t turn off the use of fossil fuels today and turn on [renewables](#) tomorrow. But we must today start diminishing the use of fossil fuels and accelerating the use of renewable fuels. And that’s where the complications come in, of politics, economics and sociology.

**Q. Shale gas development hasn’t yet happened in your own state—New York. The [New York State movement](#) has managed to stave this off for a long time. What’s next?**

**A.** Public comments on the state Department of Environmental Conservation’s (DEC) regulations.

The DEC was to have spent the last three years of shale gas moratorium [in New York State] doing the right thing: no policy recommended to the governor unless and until rigorous science-based studies of environmental, human health, and economic impacts have been performed and validated.

In my opinion, DEC has not performed rigorous science-based studies of environmental, human health and economic impacts. The DEC could have spent the last two years evaluating such impacts where shale gas development is ongoing, thus forming a basis for validation. They did not. Instead they have already proposed regulations, which should have been the last thing to check off if and only if the studies had been done and validated. I understand that democracy is messy, but the messy part should only be the political part, not the science part.

**SUMMARY:**

- Misconceptions
- Myths
- Claims by Industry
- The Realities including Dr Anthony Ingraffea interview of what fracking really is, the dangers and why it should not be undertaken.

**CONCLUSIONS AND RECOMMENDATIONS**

There is so much proven risk and so many issues as a result of fracking and therefore there should be an immediate ban on new exploration and drilling to prevent more damage to people’s lives and the land.

We are playing with everybody’s future and the environment, and if they get it wrong, how are we going to rectify that problem. When the mines close and go, we are the people left managing the problems that we have inherited.