

GASFIELD FREE PERTH HILLS

Submission to the:

WA Scientific Inquiry into Hydraulic Fracture Stimulation.

Gasfield Free Perth Hills is a group of people who reside in the Eastern Hills area of Perth. Although we understand that the Darling range is not geologically suitable for gas exploration we are very concerned at the impacts unconventional gas mining has on our wider community and the potential of polluting our aquifers. We welcome the WA Labor Governments public inquiry into hydraulic fracture stimulation and thank them for this opportunity to express our concerns with unconventional gas mining.



Highway action, Greenmount WA

The previous Liberal state government of Western Australia actively promoted unconventional gas mining across the state including granting substantial exploration licenses in the Kimberley Midwest and Southwest regions. These licenses cover large areas that supply the Perth metro, Geraldton, Broome and the South West as well as vast areas of agricultural land in the Midwest, National parks and Aboriginal lands. This has provoked growing concerns from communities who are alarmed at the social, health and environmental impacts that fracking has had in Queensland and the United States.

Hydraulic fracture stimulation, unconventional gas mining as we call it uses vast amounts of water between 10 million and over 30 million litres of water per frack. To this water is added sand and a multitude of chemicals to form fracking fluid. Each well is drilled vertically and from this vertical bore, horizontal drilling is conducted in multiple directions and at multiple depths. Each drill line can also be fracked multiple times to maintain flow rate, which can reduce within a few months. The fracking fluid is pumped at high pressure to completely fracture the tight sands and shale rock formations releasing methane gas along with a multitude of other chemicals and gases trapped. This production process creates a huge pressure cooker where inorganic and organic compounds including toxic and cancer causing substances such as benzene, toluene, xylene (BTEX) methylene chloride, Poly aromatic hydrocarbons (PHAs) Endocrine disrupting chemicals (EDCs) sulfuric oxide, nitrogen oxide, volatile organic compounds, radon gas, heavy metals and radionuclides, the list goes on and all are present in flow back fluids and fugitive emissions.

The massive amount of water consumption and pollution along with the airborne toxins that our rural communities will be subjected to should unconventional gas mining continue has brought us together to raise awareness in the Perth metro regarding the threat to our country communities and our precious water. This submission summarizes a number of these concerns.

Water-4-Life. Not Gas.

The main concern people have with fracking is its impacts on water (Hawke 2015, p. 31). Water resource impacts include contamination and depletion. Shale gas production uses a higher input of water than CSG production, but it also creates less waste water (Australian Council of Learned Academies 2013, p. 2). A shale gas well can use over 10 million litres of water to frack (Grafton 2012, p. 16).

The media often shows flammable water as examples of water contamination (Figures 1 & 2 below). Osborn et al. (2011, p. 8172) found “methane concentrations in drinking water wells increased with proximity to the nearest gas well” and were “a potential explosion hazard” in active fracking areas. Drilling fluids, flow back fluids, fracking chemicals, and naturally occurring contaminants migrating into drinking water and rivers due to fracking have also been found (Broomfield 2012). Fracking fluids containing heavy metals and acid harmed

Kentucky fish species (Papoulias & Velasco 2013). Wildlife and animals suffer similar impacts to humans (Centre for Biological Diversity, n.d.; Kelly 2011). 'Fracking Can Contaminate Drinking Water' (Vaidyanathan 2016), explains why older reports refuted fracking caused water contamination. Figure 9 demonstrates possible sources of water contamination from fracking shale gas.



Figure 1. Tap water on fire after water contamination from fracking. Source: Beament 2015.



Figure 2. CSG fracking is blamed for methane in the Condamine River. Source: Water Career 2016.

Water quality Groundwater / Surface Water

There are numerous international examples of ground water and surface water contamination as a result of shale gas activities.

“Analyses revealed that arsenic, selenium, strontium and total dissolved solids (TDS) exceeded the Environmental Protection Agency’s Drinking Water Maximum Contaminant Limit (MCL) in some samples from private water wells located within 3 km of active natural gas wells. Lower levels of arsenic, selenium, strontium, and barium were detected at reference sites outside the Barnett Shale region as well as sites within the Barnett Shale region located more than 3 km from active natural gas wells. Methanol and ethanol were also detected in 29% of samples. Samples exceeding MCL levels were randomly distributed within areas of active natural gas extraction, and the spatial patterns in our data suggest that elevated constituent levels could be due to a variety of factors including mobilization of natural constituents, hydrogeochemical changes from lowering of the water table, or industrial accidents such as faulty gas well casings.”

Fontenot, BE, Hunt, LR, Hildenbrand, ZL, Carlton, DD, Oka, H, Walton, JL, Hopkins, D, Osorio, A,

Bjorndal, B, Hu, QH & Schug, KA 2013, 'An Evaluation of Water Quality in Private Drinking Water Wells Near Natural Gas Extraction Sites in the Barnett Shale Formation', *Environmental Science and Technology*, American Chemical Society (ACS) Publications, <http://pubs.acs.org/doi/full/10.1021/es4011724>

"As part of the report, EPA identified certain conditions under which impacts from hydraulic fracturing activities can be more frequent or severe, including:

- Water withdrawals for hydraulic fracturing in times or areas of low water availability, particularly in areas with limited or declining groundwater resources;
- Spills during the management of hydraulic fracturing fluids and chemicals or produced water that result in large volumes or high concentrations of chemicals reaching groundwater resources;
- Injection of hydraulic fracturing fluids into wells with inadequate mechanical integrity, allowing gases or liquids to move to groundwater resources;
- Injection of hydraulic fracturing fluids directly into groundwater resources;
- Discharge of inadequately treated hydraulic fracturing wastewater to surface water resources; and
- Disposal or storage of hydraulic fracturing wastewater in unlined pits, resulting in contamination of groundwater resources."

United States Environmental Protection Agency 2016, *EPA Releases Final Report on Impacts from Hydraulic Fracturing* <https://www.epa.gov/newsreleases/epa-releases-final-report-impacts-hydraulic-fracturing-activities-drinking-water>

Water supply and distribution (quantity)

There have been reports of towns running out of water due to shale gas fracking in America and Canada.

"Fracking boom sucks away precious water from beneath the ground, leaving cattle dead, farms bone-dry and people thirsty."

Goldenberg, S 2013, 'A Texan tragedy: ample oil, no water', *The Guardian*, <https://www.theguardian.com/environment/2013/aug/11/texas-tragedy-ample-oil-no-water>

"The area has become rife with tension. Not between the oil and gas companies and environmentalists, but between the companies and local residents, many of them oil and gas workers themselves, and all of them dependent on the industry. Both sides are jostling for rights to what is becoming an increasingly scarce resource in the area: fresh water. The oil and gas companies are eager to stake their claims on water sources as they rush to exploit the wealth of natural resources underground. And to do that they need water. Lots of water. That

has locals fearing the disappearance of surface and ground water sources that not only act as drinking water but are also the lifeblood of hunting, fishing and recreational activity in the region.”

Hames, E 2016, Is Fracking Behind This Town's Dry Water Well?, *Alberta Venture*, <http://albertaventure.com/water/towns-in-albertas-industrial-heartland-ran-out-of-water-last-summer-is-fracking-to-blame/>

We find the use of produced water to augment town water supplies particularly worrisome: Chinchilla “weir has the dual purpose of providing supply of irrigation water along the alluvial flats of the Condamine River and of augmenting the water supply to the town of Chinchilla.” “The release of treated (CSG) water into Chinchilla Weir is regulated under Beneficial Use Approval ENBU02701811.”

Sunwater n.d., *Chinchilla Weir*, <http://www.sunwater.com.au/schemes/chinchilla-weir>

The short production life of wells is another issue to be considered when assessing the depletion of our water resources. To maintain flow rate wells have to be fracked multiple times to maintain viability. With the falling price of gas, the flow rate of gas and the number of wells to maintain viability of a gasfield must increase.

“Shale gas plays developed by hydraulic fracturing have the interesting characteristic that they are very productive initially but have **rapid decline rates**. The estimated ultimate recovery per well (EUR) may be in the billions of cubic feet but 50–75% is usually recovered in the first year of production. A typical well in the Haynesville, for example, has a EUR of 6.5 Bcfe but an initial decline rate of 85%. The Barnett (2.65 Bcfe, 70%), and Fayetteville (2.4 Bcfe, 68%) are comparable. The early production rates for Marcellus wells indicate a EUR of 4.4 Bcfe and a first year decline rate of 75%. Thus the wells will finish their productive stage in 3 to 5 years. In order for companies to keep their production level constant, they need to keep drilling and fracking.”

Lampe, DJ & Stolz, JF 2015, ‘Current perspectives on unconventional shale gas extraction in the Appalachian Basin’, *Journal of Environmental Science and Health*, Taylor and Francis, <http://www.tandfonline.com/doi/full/10.1080/10934529.2015.992653?scroll=top&needAccess=true>

Aquatic ecosystems and biodiversity

WA is reliant on aquatic ecosystems for tourism as well as profitable farming, fishing and crabbing. Many water sources are also used for irrigation and as domestic water supply for rural and remote households.

“Generally, the closer geographical proximity of the susceptible ecosystem to a drilling site or a location of related industrial processes, the higher the risk of that ecosystem being impacted

by the operation. The associated construction of roads, power grids, pipelines, well pads, and water-extraction systems along with increased truck traffic are common to virtually all HVHF operations. These operations may result in increased erosion and sedimentation, increased risk to aquatic ecosystems from chemical spills or runoff, habitat fragmentation, loss of stream riparian zones, altered biogeochemical cycling, and reduction of available surface and hyporheic water volumes because of withdrawal-induced lowering of local groundwater levels.”

Burton, GA, Basu, N, Ellis, BR, Kapo, KE, Entrekin, S & Nadelhoffer, K 2014, ‘Hydraulic “fracking”: are surface water impacts an ecological concern?’, *Environmental Toxicology and Chemistry*, WileyOnlineLibrary, [https://deepblue.lib.umich.edu/bitstream/handle/2027.42/108102/etc2619.pdf?sequence=1&isAll o wed=y](https://deepblue.lib.umich.edu/bitstream/handle/2027.42/108102/etc2619.pdf?sequence=1&isAll%20wed=y)

We have already experienced several contaminating spills in our rivers due to truck accidents and train derailments. A spill of fracking chemicals or waste water has the potential to be much worse.

Schubert, S 2012, ‘Environmental damage for Edith River still unknown after derailment’, *ABC Rural*, <http://www.abc.net.au/site-archive/rural/content/2012/s3410442.htm>

Well Integrity.

Well integrity is of enormous concern, not only while the well is productive, but for the rest of eternity. Drilling a well creates a permanent conduit between what lays kilometres underground and the surface. It is impossible to permanently plug this conduit. The quotes about well integrity below are from published peer-reviewed scientific reports and represent just a few of the many reports available.

“We need much more information on the structural integrity of older producing wells and abandoned wells. A new analysis suggests there are between 280,000 and 970,000 abandoned wells in Pennsylvania alone, most of them unaccounted for in the state database. How many of these wells leak fluids into groundwater or the atmosphere? A random survey of 19 (a small sample) showed that all of these older wells leaked methane to the air, mostly at low rates, but could be responsible for 4–13% of methane emissions from human activities in the state.”

Jackson, RB 2014, ‘The integrity of oil and gas wells’, *Proceedings of the National Academy of Sciences of the United States of America (PNAS)*, National Center for Biotechnology Information (NCBI), <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4121783/>

“In a technical sense, “well integrity” refers to the zonal isolation of liquids and gases from the

target formation or from intermediate layers through which the well passes. In a practical sense, it means that a well doesn't leak. Drilling companies emphasize well integrity because a faulty well is expensive to repair and, in the rarest of cases, costs lives, as in the Deepwater Horizon disaster in the Gulf of Mexico. Drillers use steel casing (pipes), cement between nested casings and between the outside casing and rock wall, and mechanical devices to keep fluids inside the well.

Faulty casing and cementing cause most well integrity problems. Steel casing can leak at the connections or corrode from acids. Cement can deteriorate with time too, but leaks also happen when cement shrinks, develops cracks or channels, or is lost into the surrounding rock when applied. If integrity fails, gases and liquids can leak out of the casing or, just as importantly, move into, up, and out of the well through faulty cement between the casing and the rock wall."

Jackson, RB 2014, 'The integrity of oil and gas wells', *Proceedings of the National Academy of Sciences of the United States of America (PNAS)*, National Center for Biotechnology Information (NCBI), <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4121783/>

"Pennsylvania state inspection records show compromised cement and/or casing integrity in 0.7–9.1% of the active oil and gas wells drilled since 2000, with a 1.6- to 2.7-fold higher risk in unconventional wells spudded since 2009 relative to conventional well types. Hazard modeling suggests that the cumulative loss of structural integrity in wells across the state may actually be slightly higher than this, and upward of 12% for unconventional wells drilled since January 2009."

Ingraffea, AR, Wells, MT, Santoro, RL & Shonkoff, SB 2014, 'Assessment and risk analysis of casing and cement impairment in oil and gas wells in Pennsylvania, 2000–2012', *Proceedings of the National Academy of Sciences of the United States of America (PNAS)*, National Center for Biotechnology Information (NCBI), <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4121786/>

Here are 2 more examples of the many well integrity articles stating the risks:

Oil and gas wells and their integrity: Implications for shale and unconventional resource exploitation

<http://www.sciencedirect.com/science/article/pii/S0264817214000609>

Wellbore Integrity: Failure Mechanisms, Historical Record, and Rate Analysis

<https://www.epa.gov/sites/production/files/documents/ingraffea.pdf>

Terrestrial ecosystems and biodiversity

Shale gas development causes habitat loss and fragmentation.

Pipelines and roads act as barriers to native species movement, and increased traffic will result in higher road kill rates.

“Loss of natural forest in the gas field was significantly higher compared to areas outside the gas field. The creation of edge habitat, roads, and developed areas was also greater in the gas field.” “Considering the large number of wells drilled in other parts of the eastern U.S. and projections for new wells in the future, shale gas development will likely have substantial negative effects on forested habitats and the organisms that depend upon them.”

Habitat Loss and Modification Due to Gas Development in the Fayetteville Shale

<https://link.springer.com/article/10.1007%2Fs00267-014-0440-6>

“We conclude that species and habitats most at risk are ones where there is an extensive overlap between a species range or habitat type and one of the shale plays (leading to high vulnerability) coupled with intrinsic characteristics such as limited range, small population size, specialized habitat requirements, and high sensitivity to disturbance.”

Ecological Risks of Shale Oil and Gas Development to Wildlife, Aquatic Resources and their Habitats

<http://pubs.acs.org/doi/full/10.1021/es5020482>

“Canaport LNG has pleaded guilty to federal charges under the Migratory Birds and Species at Risk Act in relation to the 2013 deaths of thousands of songbirds. The birds were drawn to a 10-to-15 meter gas flare during a period of fog and low cloud.”

Canaport LNG pleads guilty in bird kill case

<http://www.cbc.ca/news/canada/new-brunswick/irving-canaport-bird-kill-plea-1.3305351>

Public health

Protecting the health of West Australians is vital, not only to save medical expenses, but also because people will leave rural WA if their family's health is threatened. Queensland is already experiencing the phenomena of 'gasfield refugees' who have been forced from their homes due to the CSG industry there.

Drilling and fracking chemicals

Gas companies tell us that they only use a small percentage of chemicals in their fracking fluids, but neglect to tell us that this equates to a large volume in total. They also neglect to say that this small percentage of chemicals contaminates the entire volume of water that they use to frack.

It is not just the chemicals used to frack that is of concern, but also the chemicals which are brought to the surface in the flow back (produced) water.

“All substances are poisons; there is none that is not a poison. The right dose differentiates a poison

from a remedy.” “All chemicals, from whatever source – human manufacture or natural – are potentially toxic at some dose.”

<https://www.sciencelearn.org.nz/resources/365-all-in-the-dose>

Radioactive substances

NORMS or naturally occurring radioactive materials are brought to the surface in fracking flowback (produced) water as well as drilling debris.

“In North Dakota’s Bakken region, the fracking boom has generated nearly 10,000 wells for unconventional oil and gas production—and along with them, almost 4,000 reported wastewater spills resulting from the activity. A new study shows that these spills have left surface waters in the area carrying radium, selenium, thallium, lead, and other toxic chemicals that can persist for years at unsafe levels (Environ. Sci. Technol. 2016, DOI: 10.1021/acs.est.5b06349). Soils and sediments at spill sites also harbored long-lasting radium contamination, the study found.”

<http://cen.acs.org/articles/94/web/2016/05/Toxic-chemicals-fracking-wastewater-spills.html>

Mental health and wellbeing

In Queensland and New South Wales where the unconventional gas industry is forcing its hand we have seen significant conflict, disruption and social upheaval as a result. People have stated they have extreme feelings of injustice as they do not have the right to refuse land access to gas companies and that the industry is forcing itself on community. They have fears and anxiety about the much publicised health impacts, quality of drinking water and air pollutants. The images, such as these (Image 1 and 2 below), of pristine farmland and natural areas that have been turned into industrial sites with access roads, compressor stations, pipelines, flow-back ponds well heads and drill rigs send shudders of terror through their bodies as they imagine that on their own land that they have grown up on. They have great anger and a sense of betrayal that government is supporting industry rather than community and that the industry is pushing ahead rapidly with little regard to their concerns.

A study on impacted communities in South West Queensland by Delwar Hossain, Don Gorman and 3 other prominent psychiatrists in 2013 concluded (in brief). “The rural communities in this region are under sustained stress resulting from the incursion of the mining and coal seam gas industries. This has an impact on community mental health and wellbeing”

<http://journals.sagepub.com/doi/abs/10.1177/1039856212460287>

Many more personal stories of anxiety and stress due to the impact on community from dealings with the gas industry can be seen in the film “Fractured Country. An Unconventional Invasion” This film also shows how communities are now forming alliances to actively discourage the development of further gasfields

<https://youtu.be/XrE7LzZCn1E>

There are many more well made films, documentaries and televised news articles that depict the struggles community have when dealing with gas companies contemptuous, misleading and corrupt behaviours. A simple google search “Community against gas” reveals many articles.

Here in rural WA, community is on edge. The gas industry is poised, ready in wait for the moratorium to end and government to give the green light to fracking in the Kimberley and here in Mid-West. It is here that population numbers are low and community fear that government may well sacrifice their vote in exchange for campaign donations. Anxiety, tension and stress is rising, they have watched the films, they have spoken with people of their own ilk in Chinchilla, Tara and Wilkie Creek they have listened to Helen Bender who’s father George took his own life during a bitter dispute with Origin Energy.

Lessons learned from the Northern Rivers Bentley Blockade and James Price Point has instigated a large Grassroots network of people raising awareness of unconventional gas within the metro area, and with this there has been a dramatic increase in the number of West Australians who have been involved in Soft Protest. Tens of thousands on Face Book and other social media outlets voicing their concerns. Hundreds of people attending rallies in Perth such are the one outside the Labor conference last year. In suburbia where thousands of votes *do* count and where governments are elected or ousted, people are now connected to country.

As community continues to be unheard with concerns not validated by government. When a people are desperate to maintain their lifestyle and protect their families from an uncaring industry hell bent on expansion and making profit without compassion or responsibility, people will react with stronger protest.

Physical safety

“Animals, especially livestock, are sensitive to the contaminants released into the environment by drilling and by its cumulative impacts. Documentation of cases in six states strongly implicates exposure to gas drilling operations in serious health effects on humans, companion animals, livestock, horses, and wildlife. Although the lack of complete testing of water, air, soil and animal tissues hampers thorough analysis of the connection between gas drilling and health, policy changes could assist in the collection of more complete data sets and also partially mitigate the risk to humans and animals. Without complete studies, given the many apparent adverse impacts on human and animal health, a ban on shale gas drilling is essential for the protection of public health.” (p. 72)

Impacts of Gas Drilling on Human and Animal Health

http://www.psehealthyenergy.org/data/Bamberger_Oswald_NS22_in_press.pdf

“In summary, hydraulic fracturing as determined by well number or density had a significant association with cardiology inpatient prevalence rates, while well density had a significant association with neurology inpatient prevalence rates.”

Unconventional Gas and Oil Drilling Is Associated with Increased Hospital Utilization Rates

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4503720/>

“It is clear that Australia must quickly move beyond its reliance on coal for health and environmental reasons. However, when taking into consideration the uncertainties over health risks, the unfavourable comparisons with other energy options, the climate risks associated with fugitive emissions, the moral obligations Australia faces as a gas exporter, the potential displacement of renewables and doubts raised over the claim that gas will prove to be a cheap energy option, the scale is firmly tipped against the further development of unconventional gas.”

Harms unknown: health uncertainties cast doubt on the role of unconventional gas in Australia's energy future

<https://www.mja.com.au/journal/2014/200/4/harms-unknown-health-uncertainties-cast-doubt-role-unconventional-gas-australias>

There is also increased likelihood of traffic accidents due to increased gas related traffic on the roads.

Health risks of contaminants entering the food chain. We have already seen the ‘Gasfields Free’ label introduced in Australia. This article (while not peer-reviewed science) raises valid issues and highlights the lack of scientific research and data available. It provides examples of contaminants entering our food chain through air, water and soil, and impacting the health of people and animals.

Fracking Our Food Supply

<https://www.thenation.com/article/fracking-our-food-supply/>

Impacts on Aboriginal people and their culture

Traditional Owners from Mataranka, Borroloola, Maningrida, and Arnhem Land told the Senate Select Committee on Unconventional Gas Mining, Darwin Hearing, 12 April 2016, about the impacts they were already suffering from gas companies and their fears for the future.

The transcript for their joint presentation is available here:

<http://parlinfo.aph.gov.au/parlInfo/search/display/display.w3p;db=COMMITTEES;id=committees%2Fcommsen%2Fb11b69b9-6cc2-4be2-890e-4b4da4eaa521%2F0007;query=Id%3A%22committees%2Fcommsen%2Fb11b69b9-6cc2-4be2-890e-4b4da4eaa521%2F0000%22>

While not necessarily identifying as aboriginal, almost all long term West Australians have an affinity with the bush and spend a large portion of their holidays fishing, camping, and ‘going bush’. We believe this culture (not just Aboriginal culture) is also worth protecting.

Land ownership

Land ownership implies having the right to determine what occurs on the land. This right is terminated by gas companies once they gain access to a property, as in reality the gas companies control what happens where and when on the land, despite what the access agreement might say.

Jobs and Growth

It is fantasy to think the unconventional gas industry will provide West Australians with long term jobs. We have witnessed many short-term mining booms in the past, they all promise hundreds of jobs, yet employed workers from interstate (many FIFO) who left WA once the initial infrastructure works were completed.

The shale gas industry will negatively impact the livelihoods of graziers, farmers, fishermen, and those working in tourism, especially if the 'Gasfield Free' labelling gains popularity.

These are long term, sustainable industries which provide long term employment to West Australians.

"Farmers and businesses can add value to their produce and protect their regions by labelling their farm, products and services - Gasfield Free." <http://www.gasfieldfree.com.au/>

"farmers on the Surf Coast in south-west Victoria described the importance of the ban to maintain land to grow clean and safe food, and support sustainable agriculture."

The Member for Eastern Victoria Harriet Shing said, "We promised to ban fracking and we're getting it done – the livelihoods of thousands of Victorians and the reputation of their world-class produce depend on it."

Protecting Our Agricultural Heartland From Fracking

<http://www.premier.vic.gov.au/protecting-our-agricultural-heartland-from-frack>

The above information is by no means all the risks and impacts of the unconventional gas industry. However this alone should be enough information to conclude that the benefit to gas company directors and shareholders is not worth the loss of community. We call upon the current West Australian Government to place a state wide legislated ban on Hydraulic fracture stimulation in Western Australia.