

**To the Standing Committee on Environment and Public Affairs Legislative Council of Western Australia**

**Submission to the Inquiry into the implications for Western Australia of Hydraulic Fracturing for unconventional gas**

**Parliament House, Perth, WA, 6000**

**Name:** Dr Ann-Maree Lynch Calnan, BSc (Hons) PhD *W.Aust.*

Reproductive toxicologist, land occupier Gingin WA, member of the Gingin Water Group.

**Date:** 20/09/2013

**Background**

I make this submission, prompted by personal observation of the development of unconventional gas mining near our rural property on the Moore River in the Gingin region of Western Australia. My husband and I enjoy the natural beauty of the bush and the abundant wildlife on our property. Our neighbours include sheep and cattle producers and a market gardener. These activities intersect with natural bush, the river and the nearby national park, without any apparent conflict. Over the past ten months I have been concerned by the development of unconventional gas mining and the production of a gas processing plant in our region. At night, gas flares can be seen on a hillside a few kilometres to our south. It is my understanding that much of the Gingin region is under a gas exploration permit. I have grave concerns that large scale unconventional gas mining involving hydraulic fracturing is planned for the region. As a reproductive biologist, I am well aware of the serious effects of environmental degradation and pollution that are associated with this industry, and how these can impact on the health and well-being of humans, wildlife and livestock. I welcome the Legislative Councils inquiry.

**Introduction**

The rapid expansion of the large scale unconventional gas mining across the globe utilising the technique of hydraulic fracturing (fracking) represents a major uncontrolled experiment, that while providing short-term economic benefit has the potential to cause long term environmental damage on a large unprecedented and unpredictable scale and have deleterious effects on human health across many generations.

The process of hydraulic fracturing for unconventional gas mining requires the use of large volumes of water<sup>1</sup>, whereby slurry of chemical laden water is injected under pressure into the coal/shale seams to fracture the deposits and release the gas. Water is drawn from the aquifers or surface water to facilitate hydraulic fracturing.<sup>1</sup> The chemicals used in fracturing solutions can include known carcinogens, neurotoxins and endocrine disruptors.<sup>1</sup> As the wells extend through aquifers or in the vicinity of aquifers, the risk of contamination of the subterranean water is significant.

There are reports from Queensland and NSW of environmental contamination and social concern as a consequence of coal seam gas mining.<sup>2,3</sup> Arrow Energy confirmed that toluene, ethylene and xylene had been identified in monitoring

bores in south east Queensland.<sup>4</sup> In NSW the mining company Metgaso, was found in breach of its licensing agreement for disposing of millions of litres of waste water from their gas mine into a local sewage plant.<sup>5</sup>

In Western Australia, on-shore unconventional gas mining and hydraulic fracturing has been in operation on a small-scale for many years.<sup>2</sup> However, extensive on-shore gas deposits have been found in the Canning basin, the Perth basin (extending from Geraldton to the northern suburbs of Perth) and the Margaret River region in the states south west.<sup>2</sup> It is expected that mining permits for hydraulic fracturing of these deposits will be sought. These regions encompass the pristine and unique Kimberley, major tourist destinations, prime agricultural and pastoral lands, rivers, vast areas of native bush, national parks and coastal wetlands.

It is notable that government concerns regarding the safety of this mining process have prompted the governments of France, Luxembourg and Bulgaria to ban fracking.<sup>6</sup> In other countries, regional and local governments in the US, Canada, Spain, Argentina, Switzerland, Austria and Australia (NSW) have placed moratoriums on the activity until adequate reviews can be undertaken and safety can be assured.<sup>6</sup>

## **Points of reference**

### **a) How hydraulic fracturing may impact on current and future land use**

Large quantities of water are required for the fracturing process and this can be drawn from both ground and surface waters.<sup>1</sup> The Australian National Water Commission position statement 2011<sup>7</sup> notes that projections for the Australian Coal Seam Gas industry indicate that as much 7,500 gigaliters of ground water could be extracted over the next 25 years.<sup>7</sup> This water is essential to maintain current ecosystems and farming activities in a country where water is a scarce national asset, and in many regions, is already heavily over allocated.

Hydraulic fracturing also has the potential to pollute surface and ground water systems.<sup>1</sup> Many of the chemicals used in fracturing fluids are known or suspected carcinogens, neurotoxins, endocrine disruptors and teratogens.<sup>1</sup> While good scientific evidence exists on the toxicity of individual agents, the likelihood of additive toxicities with combined substances is poorly understood.<sup>8</sup> This raises the possibility of enhanced toxicity at lower doses.<sup>8</sup> Further, the chemistry of the fracking fluid is altered when it comes in contact with coal/shale deposits and the flow back water is contaminated with salt, radionuclides, heavy metals, and aromatic hydrocarbons.<sup>9,10</sup> This poses serious issues in regard to waste disposal and purification.

Well failures, surface spills, leakage of flow back water and inadequate treatment and disposal of waste water are all potential areas at which contamination can occur.<sup>1</sup> It is often claimed that as the WA shale deposits lie at great depth<sup>2</sup> from 2 to 4 Km, that this depth protects the aquifers from pollution. In fact, wells may be sunk close to aquifers and any corrosion of a well places the ground water at risk of contamination.

Additional risks arise from seismic activity that can cause land subsidence and create new connections between aquifers, extending the pollution some distance from the wells.<sup>7</sup>

The primary issues of water depletion and water pollution impacts across all areas of land use.<sup>9</sup> This ranges from indigenous land use and the rights of indigenous Australians to hunt, fish and gather food within natural ecosystems. The depletion of water flow into rivers, streams and wetlands has the potential to cause degradation and possibly cause complete removal of natural habitats, native plants and animals. Pollution and environmental degradation could extinguish native species. Shale gas mining is incompatible with farming activities and food production. Farming competes with unconventional gas mining for water resources. Farming practised in specific regions could be placed at risk, livelihoods lost, regional food production capacities seriously reduced and properties devalued. Obvious conflicts exist between tourism and mining due to the negative visual impact of the mines, the associated infrastructure and heavy vehicles, and the progressive degradation of the natural environment. It could be expected that the tourism industries of the Margaret River region and the Kimberley would be seriously affected by large scale hydraulic fracturing mining.

Due to the serious risk of environmental damage posed by this industry, it would be prudent that areas of high conservation value such as national parks, areas of significant biodiversity, drinking water catchments, wetlands, regions containing rare and endangered species and subterranean ecosystems be exclusively protected from mining. Protective measures should not only prohibit mining in these regions, but also consider surface drainage and water flow patterns that support such regions and wide buffer zones should be put in place.

Under current legislation landowners are powerless to prevent mining companies occupying their land. Such laws were determined at a time when the population was small and are no longer appropriate. There is an important need for legislative change to protect the rights of land owners and enable them have control over what mining activities are carried out on their land.

## **b) The regulation of chemical used in the hydraulic fracturing process**

In the US it is noted that 14 oil and gas companies are currently undertaking hydraulic fracturing.<sup>1</sup> Some 2,500 products have been manufactured for the fracturing processes that contain 750 chemicals.<sup>1</sup> To date, 780 million gallons of fracturing product (excluding water) has been sunk into the wells in the US.<sup>1</sup> These chemicals include 29 known or possible carcinogens, in addition to mutagens, endocrine disruptors and neurotoxins.<sup>1,9</sup> As such, hydraulic fracturing fluids can be classed as hazardous substances.

A large body of scientific evidence has identified chemicals that can act as carcinogens, neurotoxins, teratogens, and endocrine disruptors.<sup>11</sup> The toxic effects of a chemical on an organism are dependent on a number of factors. These include: the inherent toxicity of the chemical, the dose to which the organism is exposed, the route of exposure, duration of exposure and specific vulnerabilities of the victim that include gender, age group and critical stages of development such as embryonic and fetal development.

The adverse effects of some chemicals on the health of humans, wildlife and livestock can occur at very low doses, or if exposure occurs over long periods of time or at critical stages of development.<sup>12-23</sup> The toxic effects of some chemicals may not be apparent for many years, for example male infertility as a result of intrauterine exposure to reproductive toxins and endocrine disruptors.<sup>12</sup>

Chemicals of significant toxicity identified in hydraulic fracturing fluids include: benzene, toluene, ethylbenzene, xylene, acetone, butyl benzyl phthalate, dibutyl

phalate, methyl ethyl ketone, naphthalene, methanol, isopropyl alcohol, 2 butoxyethanol, petroleum distillates, diesel, ethylene glycol, glutaraldehyde, thiourea, nitrilotriacetic acid, dimethyl formamide, benzyl chloride, lead, copper acrylamide and phenols.<sup>1</sup>

Thousands of wells are proposed for some regions in WA. Conservative estimates of well failures/leakages in the order of only one or two percent, clearly indicate the potential for significant pollution of ground and surface water across regions. Surface spills of fracturing fluid or motor vehicles accidents involving trucks hauling toxic chemicals also have the potential to pollute surface waters.<sup>9</sup>

There is an important need for the establishment of an independent panel of experts to evaluate the short and long term risks of chemicals on the environment and public health. This panel should have the power to ban the use of certain chemicals and place stringent controls and monitoring programs on the use of potentially hazardous chemicals.

### **c) The use of ground water hydraulic fracturing process and the potential for recycling of produced water**

The potential serious environmental threats posed by utilising ground water for hydraulic fracturing was addressed in reference point a).

The disposal of the water extracted from the hydraulically fractured wells represents a technological challenge.

Each hydraulic fracture can use 5 million gallons of hydraulic fracturing fluid<sup>1</sup> and of this, 10 to 70% of the injected hydraulic fluid can be recovered as waste water.<sup>1</sup> Given the scarcity of water in Australia, the purification and recycling of this fluid is desirable.

Waste water typically has a high salt (sodium chloride) content<sup>10</sup> and can be contaminated with phenols, radionuclides, nitrate, bromine, heavy metals, oils and aromatic hydrocarbons.<sup>1,9,10</sup>

The discharge of any untreated water from hydraulically fractured wells into the ground water, surface streams, wetlands or geological formations should be prohibited.

Technologies need to be developed to ensure that waste water is purified prior to any re-use. The safe storage, recycling and discharge of this water should be the responsibility of the mining company. Independent monitoring of all stages of waste water recovery, storage, treatment and discharge should be carried out and heavy fines should be applied for any breaches in required processes and environmental management.

### **d) The reclamation of land that has been hydraulically fractured**

Risks of environmental contamination exists post termination of mining activities. This can occur through seepage of contaminated material into ground and surface water and into the soil. Reclamation of land that has been hydraulically fractured should be the responsibility of the mining company. Processes of independent environmental monitoring, assessments and review needs to be continued until the sites are deemed contaminate free and reclamation if possible, completed.

## **Other - Regulation of the WA on-shore gas industry, environmental and health monitoring, liability and compensation**

In WA the Department of Mines and Petroleum (DMP) administers on-shore petroleum activities under various acts including the *Petroleum and Geothermal Energy Resources Act 1967*.<sup>2, 24</sup> Environmental impact reports are assessed by the DMP and referred to other agencies, such as the Environmental Protection Agency if they consider the environment to be at risk. Thus, the DMP has a conflict of interest between promoting mining in WA and setting down tight environmental controls and monitoring. It is encouraging to see that the DMP acknowledges deficits in the current regulatory process and has produced a consultation paper with proposed amendments to the Mining Legislation.<sup>25</sup>

There is an important need for an independent regulatory authority to assess mining applications and provide on-going environmental monitoring throughout the life of each well. These processes should be transparent and full public disclosure should be provided. Mandated procedures should include baseline water quality testing of surface and ground water sources prior to the commencement of any drilling, detailed hydrological assessments of the location of aquifers and surface and ground water flow patterns across all seasons and for on-going water quality testing throughout the life of each well including decommissioning and land reclamation phases. This should be governed by an independent authority. If contamination is identified, mining activities should be suspended, the company should be held responsible and be required to pay heavy fines and compensation to land owners or government as applicable.

Under the current system, fines for spills and other breaches are low; for example \$10,000 for failing to submit an environmental plan, and \$5,500 for failure to notify a reportable incident.<sup>24</sup> A structure of heavy fines would encourage responsible environmental management. Consideration should be given to the introduction of bonds and other assurances.

Regulation in Australia of the accuracy of chemical disclosure on material data safety sheets is poor. Disclosure is generally dependant on the willingness of companies to disclose full product details on the composition and characteristics of their products. Review of the regulatory process to ensure full and accurate disclosure is required.

There is a need for the establishment by the WA Health Department of a monitoring program of the health and well-being of local populations in regions where the mining of shale gas deposits by hydraulic fracturing is occurring; focus should be placed on the incidences of cancers, birth defects and male infertility within these communities.

## **Conclusion**

Rapid, wide spread expansion of the unconventional gas mining industry utilising hydraulic fracturing is planned for Western Australia.

The risks this industry poses to the environment and to human health are high. Current legislation and regulation of the industry needs to be urgently revised and a process of independent environmental assessment and monitoring needs to be put in place.

I call for an immediate moratorium on unconventional gas mining utilising hydraulic fracturing and that this is imposed until adequate independent reviews can be undertaken and safety can be assured.

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