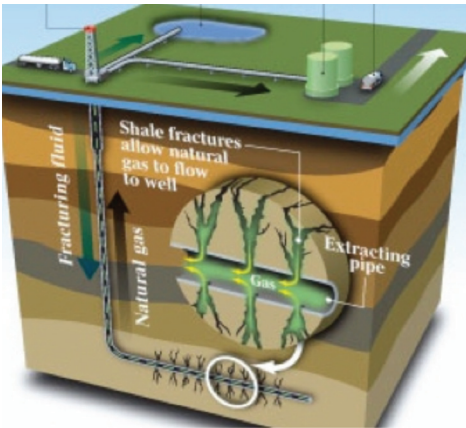


# What the Frack?

## The threat of fracking and onshore unconventional gas in WA

Briefing Paper - January 2012



Hundreds of tons of chemical mixed with water are forced at extreme pressures to fracture underground rock formations and release gas

### What is Unconventional Gas?

“Unconventional gas” refers to methane<sup>1</sup> gas deposits that until now have been either technically unrecoverable or economically unviable. Typically, ‘unconventional gas’ is onshore gas deposits trapped within deep geological formations with very low permeability, and often contained within shale rock, coal deposits or tight sandstone. These gas deposits require expensive, technical drilling operations and ‘fracture stimulation’ (or ‘fracking’) to extract gas at a viable rate.

Today’s high domestic gas prices and global demand for energy has caused a boom in exploration and production of onshore unconventional gas worldwide.

### WHAT IS.....

#### Coal Seam Gas?

Coal seam gas (CSG), also known as coal bed methane (CBM), is methane which has been absorbed into the solid matrix of the coal deposit. Coal seam gas is distinctly different from other gas deposits as the gas is actually in a near liquid state lining the inside of pores within the coal. ‘Free’ gas can also be stored within natural open fractures within the coal, called ‘cleats’. Coal seams typically occur at depths of 500 – 1500m.

In most cases, to extract gas from coal requires drilling into the coal deposit, then drilling horizontally along it, then hydraulically fracturing (‘fracking’) the coal to create fissures through which the methane can escape into the well bore. Not all CSG wells require fracking; simply dewatering of the coal seam can sufficiently de-pressurise the gas allowing it to migrate into the well.

Underground Coal Gasification (UCG) is another method of extracting methane from coal. This is a process by which oxidants are pumped into the coal seam via an injection well; the coal is then set on fire and burned underground at temperatures of up to 1500 degrees Celsius. The gas is extracted via a second ‘production’ well. Fracking is often used to increase the flow of gas between the injection well and the production well.

#### Shale Gas?

Shale gas is methane trapped within shale rock formations. The gas is absorbed into the organic material in the shale rock. Shale formations which hold commercial quantities of gas usually have a high organic content (0.5 – 25%). Shale rock formations in Western Australia usually occur at depths of 1500 – 4000m.

Shale rock has very low permeability, so in order to extract the gas, the shale formation also requires horizontal drilling into the shale and fracking to create a viable rate of gas flow. All shale gas wells require fracking.

#### Tight Gas?

Tight gas refers to methane gas trapped between the fine grains of ‘tight’ sand formations (sandstones). As with shale gas, gas absorbed and trapped within tight sand formations requires fracking to increase the permeability of the formation and release the gas to allow it to flow into the wellbore at a viable rate. Some tight gas wells flow quite a lot of gas for a short period of time when first drilled, but all tight gas wells will require fracking to release gas at a sustained and viable rate.

## WHAT IS HYDRAULIC FRACTURING?

Hydraulic fracturing - 'fracking', 'fraccing', 'hydrofracking' or 'hydraulic stimulation' - is the process used to create fractures and fissures in source rock formations that hold unconventional gas such as coal seams, shale and sandstone. In most cases, a well is drilled vertically down to the target formation, then horizontally through the formation. Small explosive charges are then set off at intervals along the horizontal section to make a series of small cracks in the target formation. Multiple horizontal wells can be drilled from the main vertical section of the gas well. Multiple layers of shale and tight formations can be drilled into and fracked from the main well.

A typical single shale/tight gas frack in WA requires a mixture of approximately 5 million litres of water and approximately 25,000 litres of chemicals (conservative estimate based on chemical additives of 0.5%; most 'slick-water frack fluid' mixes consist of 0.5% to 2% chemical additive)<sup>2</sup> to be pumped at extremely high pressure (15,000psi) into the well to fracture the formation through the cracks generated by the explosive charges. The fractures in the rock are then kept open with a 'proppant' (grains of sand or ceramic beads) that are introduced to the fracturing fluid.

On average, a shale gas well requires up to 15 fracks (3 lateral wells drilled horizontally from the main vertical well, with 5 frack stages per lateral) in order to produce gas at a viable rate of sustained production. Some wells in the US are undergoing much larger fracking operations as the industry grows. The largest fracking operation to date (in the US) consisted of 274 fracks over a 111 day period requiring an unknown, but huge, volume of chemicals.<sup>3</sup>



Hundreds, or possibly thousands, of wells are needed to develop an unconventional gas field – as seen here in the USA. Onshore unconventional gas developments turn wilderness areas and prime farmland into full blown industrial wastelands.

## WHAT ARE THE ENVIRONMENTAL CONCERNS?

### Underground Water and Fracking

To drill and fracture a well is an extremely water intensive process. The Department of Mines and Petroleum WA (DMP) recently revealed that a single frack in WA will use, on average, 5 million litres of water. A further 4 million litres of water is used to drill the well. All up, an average shale or tight gas well will use approximately 30million litres of water. This applies unnecessary stress on the dwindling groundwater resources that WA's natural environment, agriculture and communities rely on.

Fracking operations currently being undertaken in the Perth Basin – without EPA assessment - are all directly below the Yarragadee and Parmelia aquifers, putting South West WA's most valuable water resources at risk.

The DMP has assured the public that there is no risk to our aquifers from hydraulic fracturing of shale or tight formations as the formations in WA are of "great depth"<sup>4</sup>. However, WA's shale and tight formations are the same depth as those in the US that are causing major problems.<sup>5</sup> Studies showing evidence of groundwater gasification due to exploration and development of shale and tight formations in the US are based on formations that occur at similar depths to formations in WA.

Chemicals commonly associated with fracking include hydrochloric acid, benzene, toluene, xylene, formaldehyde, aldehyde, polyacrylamides and chromates. Of 23 commonly used fracking chemicals used in Australia, only TWO have been assessed for safety by the Australian National Industrial Chemicals Notification and Assessment Scheme (NICNAS)<sup>6</sup>. Many of the commonly used chemicals associated with fracking are known carcinogens. Recently, benzene, toluene and xylene have been banned for use in fracking in some parts of Australia. These three chemicals are, however, naturally present in coal seams and shale and are released when fracking of any hydrocarbon bearing formation occurs. Simply banning the use of these chemicals in fracking does nothing to control their release into the environment. Many other chemicals are used in fracking but the companies are not required to disclose exactly which chemicals or in what concentrations.

Radioactive material – in the form of Radium 226 - is also present in shale and coal seams. Fracking wastewater in the US has been found to have up to 32,000 times more radionuclides than drinking water standards allow<sup>7,8</sup>. Fracking can release these chemicals and radioactive material into the environment including groundwater drinking supplies.

The three most common ways in which contaminated frack fluids and/or gases can make their way into our groundwater are:

- Migration of fluids/gases through small existing underground fault systems
- Migration of fluids and gases along the outside of the gas well casings
- Leaching of surface wastewater ponds into shallow aquifers<sup>9</sup>.

Before any wells are drilled companies conduct 3D seismic surveys of the underground geology to find the layers of gas bearing formations and find the best places to conduct drilling and fracking. 3D seismic surveys are also used to find geological fault systems. Companies try to avoid fracking too close to fault systems. However, the very best 3D seismic survey data cannot find all faults, in fact, about 20% of all minor fault systems are not detected by seismic survey.

Internal government documents recently obtained by The Wilderness Society WA include an assessment of aquifer connectivity surrounding a proposed fracking operation 250km north of Perth. The internal assessment states that, *“the hydraulic properties along the faults in the area are difficult to assess as **specific investigations have not yet been undertaken** however, where permeable strata are juxtaposed across a fault there could be groundwater flow between aquifers.”*

**The proposed fracking operation, which is in the middle of a gazetted nature reserve, is ‘estimated’ to extend to within 150m of a major fault – the Peron Fault. The EPA chose not to assess this proposal.**

To produce all recoverable gas from an unconventional gas field, hundreds, or maybe even thousands of wells need to be drilled. The more wells that are drilled in an area the greater the likelihood of a well intersecting an undetected fault system. For companies to continue economically viable operations, they need to continue drilling hundreds of wells, as wells only flow at viable rates for 5-10 years, with peak flow occurring in the first 1-3 years.

The risk of gas and fluid migrating along the outside of well casings also increases as multiple fracking operations can intersect existing fracked wells. In the Barnett shale region in the US, 7,931 wells were drilled from 2000 to 2008<sup>10</sup>. This “fracking frenzy” is indicative of the way unconventional gas fields are developed. The DMP has promoted a US style ‘fracking frenzy for Western Australia.’<sup>11</sup>



**3D seismic survey tracks scar WA wilderness**

It is also common for gas companies to dispose of huge volumes of wastewater by injecting it deep underground at high pressures. This practice could result in migration of wastewater through fault systems.

Casings that are designed to protect groundwater from contamination are likely to, and in fact do, corrode over time. A senior officer of DMP recently told a stakeholder reference group meeting held at the EPA offices in Perth that we need not worry about the likelihood of failure of abandoned gas wells due to casing corrosion because “well casings do not corrode, they are good for a lifetime - up to 100 years”.

This is an entirely rhetorical statement. In fact, casing corrosion is a common problem in the petroleum industry.

For example, a conventional oil well – Hovea 8 - in the northern Perth basin, operated by Origin Energy, had to be ‘shut in’ earlier this year due to casing corrosion during production.<sup>12</sup> This well had only been in operation for 8 years and was not subject to the high pressures of fracking or high volumes of unknown chemicals used in the fracking process.

**In WA, nobody is held responsible for failure of abandoned wells. Future generations will be left with this legacy.**

## Surface water contamination and fracking

Fracking operations in WA are currently being undertaken – without EPA assessment - on prime farmland and within the water catchments of internationally and nationally significant wetlands, major river systems and Kimberley floodplains. All WA fracking operations are within the state's declared 'Water Resource Areas'.<sup>13,14</sup>

Huge volumes of chemicals, fuel, and wastes need to be kept on-site during drilling and fracking operations. Spills of up to 500L do not need to be reported under Western Australian legislation.

Drilling waste in WA does not need to be stored in plastic lined ponds, instead it is usually kept in earthen 'evaporation ponds.' Conventional oil and gas exploration drilling uses fine bentonite clay as a drilling lubricant. However, shale/tight gas exploration drilling requires the use of synthetic chemical drilling fluid additives as clays 'damage' the shale/tight formation and inhibit gas flows.

Drilling additives being used in WA right now are proven to cause eye, skin and respiratory irritation as well as central nervous system effects. Shale 'cuttings' brought to the surface during drilling can contain high levels of Radium 226.



Fracking wastewater is typically stored in open, plastic lined wastewater ponds. Large quantities of fracking wastewater also come to the surface through routine venting and flaring during flow testing of the well. The 'flare pit' is earthen, just like the drilling waste pond. It is usually not until the flare pit is completely filled that it overflows into the fracking wastewater pond. Fracking wastewater is left to seep into surrounding soils of the flare pit. Both the drilling waste pond and the fracking wastewater pond are generally designed to hold the estimated volume of waste water that will be recovered from the well. Unforeseen high rainfall events can result in overflow of these wastewater storage ponds.

**WA's first dedicated shale gas well – north of Perth in our famous 'wildflower country' -with an unlined drilling waste pond.**

## Waste water treatment and disposal

Most water treatment facilities are not designed to handle fracking wastewater due to the chemical additives in the fluid and also due to the huge volumes of wastewater generated by fracking. Wastewater from fracking is often left in large ponds to eventually evaporate. This also causes release of toxins into the atmosphere as some of the chemicals in the wastewater 'off-gas'.

Another common way companies dispose of huge volumes of wastewater is by injecting the waste at high pressure deep into the ground. The Department of Mines and Petroleum (DMP) recently announced that they support this method of wastewater disposal. This method of wastewater disposal has resulted in earthquake swarms in the US state of Arkansas. (see below)

No current method of water disposal deals with the problem of remaining chemicals and radioactive material. Even after evaporation or filtration, chemicals and radioactive material remain and have to be disposed of – probably by burial. The world's best transportable industrial water filtration system recently released for use by the unconventional gas industry in the US does not treat water to a standard that can be released safely into the environment. Water treated by this system still requires deep injection or evaporation for 'disposal'.<sup>15</sup>

## The surface footprint

The surface footprint of unconventional gas starts at the beginning of exploration. Tracks are initially cleared in a grid pattern across the landscape to conduct 2D and 3D seismic surveys to determine where to focus their drilling efforts. If an area is found to have significant gas and is finally developed into a producing gas field, hundreds or even thousands of wells could be drilled and fracked. Each individual well requires up to 35,000 square metres of land to be cleared. In an operating gas field, every well will be connected via piping and every well will require vehicle access. A road plus pipeline easement can be up to about 40m wide.

A gas field eventually ends up resembling a giant pin cushion, with every pin connected to one another by roads and pipes, destroying farmland and fragmenting natural ecosystems to the point of collapse.

Gas mining operations in the Perth Basin are causing the spread of the fungal disease *Phytophthora* – 'dieback' – through gazetted Nature Reserves in WA's iconic 'wildflower country'. Dieback is a soil pathogen which kills native vegetation and can be spread via vehicles and earthmoving works. The Perth Basin is part of an internationally recognised 'global biodiversity hotspot'. WA's Kwongan heathland, an area being targeted by the onshore gas industry, is the second most florally diverse ecosystem on the planet. Dieback is one of the single biggest threats to the biodiversity of Southwest WA.<sup>16</sup>

A huge amount of industrial infrastructure is required to operate a gas field, including central processing plants, compressor stations, site offices, workers camps, equipment storage areas, chemical storage areas, condensate tanks and all-weather heavy haulage transport roads. Gas fields quite literally turn farmland, wilderness areas and regional communities into large scale industrial centres.

## Shale formations and radioactive materials

Due to the maturity of shale rock, along with its high organic content, shale can also contain very high levels of radioactive Radium 226. Once removed from its source rock deep in the earth and exposed to water and air, radium starts to decay rapidly and has a half-life of 1600 years. The decay product of radium is radon gas. Radium is over 1 million times more radioactive than the same mass of uranium.<sup>17</sup>

A recent study of fracking wastewater in the US has revealed that wastewater from fracked shale gas wells contains levels of radionuclides 3,200 times higher than US safe drinking water guidelines.<sup>18, 19</sup>

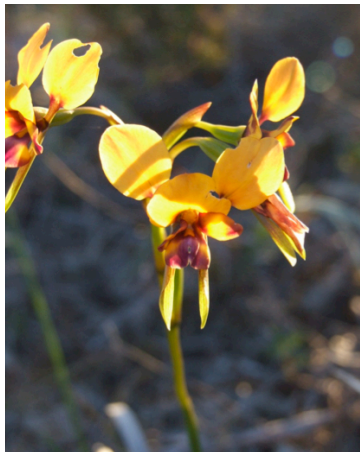
## Earthquakes

During the fracking operation, frack fluids can migrate at high pressure into unmapped fault systems and, in effect, liquefy and lubricate the fault, causing the fault (which was previously inactive) to slip and move – thus causing an earthquake. Injection of fracking wastewater deep into the ground at high pressure can also cause earthquakes. Some earthquakes associated with fracking have reached magnitude 4.7 which is strong enough to cause property damage to surrounding communities.

Fracking and associated unconventional gas industry activities have been blamed for earthquake swarms in Blackpool (UK) and Arkansas and Oklahoma in the US. Fracking is highly likely to have caused the earthquakes in Oklahoma and Blackpool.<sup>20, 21</sup> Wastewater injection has been blamed for earthquakes in Arkansas.<sup>22</sup>

Earthquake swarms in a gas field are of great concern. Earthquakes can cause cement well casings to crack and fail in other gas wells, causing further problems of groundwater contamination and gasification.

The industry has known for decades that deep injection of wastewater is likely to cause earthquakes. In the late 1960's the US Army wastewater deep injection well in Denver, was proven to be the cause of thousands of earthquakes,<sup>23</sup> the strongest being in excess magnitude 5. Yet the gas industry still uses deep injection as a primary means of disposal for huge volumes of wastewater, as the issue of wastewater treatment cannot yet be solved.



Unconventional gas – one of the single largest threats to WA's internationally recognised biodiversity

## Is unconventional gas a 'clean', 'cheap' energy solution?

Gas produced by fracking shale and tight formations is NOT a clean energy source.

Over their full life cycle, from exploration to end use, shale gas projects are a higher greenhouse gas emitter than conventional gas, and possibly oil or even coal. The main source of emissions which make gas derived from shale / tight formations such a dirty fossil fuel are 'fugitive' emissions of methane (CH<sub>4</sub>), plus CO<sub>2</sub> emissions from production, processing, transport and end use.

Studies based on technical data from hydraulic fractured shale gas wells in the US shows that the very high carbon pollution from shale gas developments makes this possibly the world's dirtiest fossil fuel.<sup>24</sup>

Over the average life of shale gas wells, between 3 and 8% of the total production of a well is emitted into the atmosphere as pure methane – one of the world's most potent greenhouse gases. The gas is emitted during well testing, routine venting and from common equipment leaks. Methane is also emitted with flow-back return fluids following the fracking of the well.

Drilling unconventional gas wells is extremely carbon intensive. The Tyndall Centre for Climate Change Research estimates that CO<sub>2</sub> emissions from drilling of shale gas wells amount to 15kg CO<sub>2</sub> per foot drilled from diesel powered engine use alone<sup>25</sup>. In addition, diesel use during the hydraulic fracturing process adds significantly more carbon pollution.<sup>26</sup> On average 110,000 litres of diesel is used to frack a shale or tight formation.

For an average West Australian shale gas well, carbon pollution from drilling and fracturing combined, will likely result in at least 495 tonnes of CO<sub>2</sub> emissions per well from diesel engine use alone. Total emissions including gas processing, transport, end use, and fugitive methane emissions will greatly exceed this estimate. Australia currently has no standard methodology to measure fugitive emissions, enabling the gas industry to get away with releasing massive amounts of methane gas into the atmosphere with no standard for measuring or reporting these emissions under current legislation.

## Shale and tight gas is not cheap energy either.

A single shale/ tight gas well costs approximately \$13million to bring into production.

The WA State Government's draft Energy Strategy<sup>27</sup> is heavily focussed on the development of unconventional gas as WA's next domestic energy source, however this would cost \$billions and would further lock WA into a future of buying dirty, carbon-intensive fuel.

Western Australia has access to world-class renewable energy resources that can be developed and brought online at a cost comparable to gas fracking, with a fraction of the environmental impact.

For example, the Verve Energy 10 Megawatt photovoltaic solar project in WA's Midwest will only cost \$50 million.<sup>28</sup> New solar technology in Europe has now overtaken conventional photovoltaic solar panels and is producing 24 hour base-load power.<sup>29</sup>

In the United Kingdom, a report recently found that the amount of investment needed to exploit gas reserves – about £32bn – would be enough to build 2,300 offshore wind turbines. It was also found that shale gas supports fewer jobs than renewable energy generation.<sup>30</sup>

As is the case with coal, shale should be viewed as just another dirty fossil fuel source blocking the road to renewable energy.

## IS YOUR AREA AFFECTED?

In Western Australia, sedimentary basins likely to contain significant unconventional gas resources extend across approximately 1/3 of our state. These are the Canning Basin, Officer Basin, Eucla Basin, Carnarvon Basin and Perth Basin. (see petroleum titles map – current July 2011).<sup>31</sup>

**The Canning Basin** covers the west Kimberley and extends through to the north and east Pilbara. Almost the entire Canning Basin is now covered by active petroleum exploration leases. Some of the companies active in this area include Buru Energy, Oil Basins Ltd, New Standard Energy, Conoco Phillips and Mitsubishi Corporation. The main focus is on shale gas and tight gas. There are also two tenements focusing on coal seam gas. **Fracking is happening in this region now.**

There are multiple plans and proposals to build infrastructure in the Kimberley to facilitate the full scale development of the Canning Basin. These include the Great Northern Pipeline (Buru Energy) James Price Point Gas Hub and deepwater port (state government) and also a plan to develop another export port and possibly petroleum processing facilities at Point Torment in King Sound (Buru Energy – Mitsubishi)

**The Officer Basin** covers much of central and eastern Western Australia from the southern edge of the Canning Basin down to the Nullarbor. Due to its remoteness and distance from any supporting infrastructure, the Officer Basin is largely unexplored and contains only a small number of active petroleum exploration tenements.

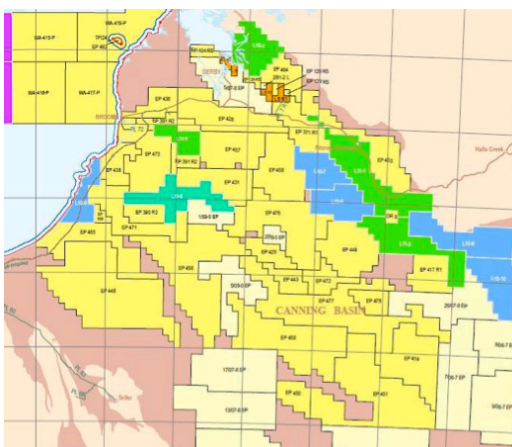
**The Eucla Basin** joins the south and west edge of the Officer Basin. It extends east to the state border, down to the south coast and stretches as far west as Ravensthorpe. Like the Officer Basin, the remote nature of this basin has meant that it is largely unexplored. There are a small number of petroleum tenements north and east of Esperance.

**The onshore Carnarvon Basin** begins just south west of Dampier to as far south as Geraldton. There are many exploration tenements focussed around industrial sites and towns such as Onslow, Exmouth, Carnarvon and Geraldton. The Dampier to Bunbury pipeline runs along the eastern edge of this basin. New Standard Energy is set to begin exploration targeting Shale and Tight gas in the region.

**The Perth Basin** joins the southern edge of the Carnarvon Basin and continues down the west coast almost as far as Windy Harbour on the south coast. There is a lot of exploration underway throughout the Perth Basin and particularly the northern Perth Basin (i.e. northern agricultural region) where there are significant shale gas deposits, with some production already underway. From just north of Perth (Eneabba to Gingin area) and extending south to the Margaret River area, the focus is shale gas and tight gas. Exploration for both is progressing rapidly. Companies are operating in areas of native vegetation, including Nature Reserves, nationally significant wetland catchments, WA's iconic 'wildflower country' and the Whicher Range, south of Busselton. Exploration is also underway on private farmland north of Perth. Of significant concern in the Perth Basin are the Yarragadee and Parmelia aquifers which supply water to towns and cities throughout the region. Some of the companies active in this area are: AWE Ltd, Norwest Energy, Latent Petroleum, Transerv Energy, Origin Energy, Bharat Resources and Empire Oil and Gas. **Fracking is happening in this region now.**



Sedimentary basins in WA



Active petroleum tenements in the Canning Basin – Kimberley. Tenements cover major floodplains, The catchment of the majestic Fitzroy River, wilderness areas, national heritage areas, communities and major tourist centres.



Active petroleum tenements in the Perth Basin – Midwest and Southwest. Tenements cover prime agricultural land, vital water catchments, the bushland of WA's iconic 'wildflower country', major towns and the Margaret River wine region.

## REGULATORY FAILURE: The lack of WA legislation and industry regulation

Two separate independent reports have exposed the fact that the WA Government's preferred approach to regulating fracking (and mining generally) is totally inadequate.

All hydraulic fracturing activities are currently regulated by the DMP under the *Petroleum and Geothermal Energy Resources Act 1967* and the *Petroleum Act 1967*.

However it was recently revealed via the Hunter Report that the environmental regulations set under these Acts are not legally enforceable by DMP.<sup>32</sup>

Separately, the WA Auditor General's report found that the Department of Mines and Petroleum is comprehensively failing in its duty to manage the environmental impact of all mining activity in WA.<sup>33</sup>

**This means that gas fracking is happening in Western Australia with effectively no conditions or compliance enforcement to protect the environment, groundwater or public health.**

Internal government documents obtained by The Wilderness Society WA revealed that a gas well near the town of Dongara – north of Perth – was fracked without the company, Arc Energy (now AWE Ltd), even submitting an Environmental Management Plan to the DMP.

Given these alarming findings, it is impossible for the community to have confidence in the Government's current approach to regulating fracking activity in WA.

If a gas fracking project is considered by the DMP to be likely to have a significant effect on the environment, the project MAY be referred to the Environmental Protection Authority (EPA) for assessment under Western Australia's *Environmental Protection Act 1986*. However at the time of publishing this document, none of the gas fracking activities proposed or underway in WA had been assessed by the EPA.



**Unlined drilling waste pond in bushland - Perth Basin. At this well, the company has cleared 10,000 square meters more than their environmental management plan allowed for. Government departments are failing to regulate the industry.**

Members of the public can also refer projects to the EPA for assessment; however this requires knowledge of the proposals. There is no requirement for the gas industry or the DMP to disclose details of gas fracking proposals in WA to the general public.

**In WA there is no requirement for public disclosure of the chemicals used in hydraulic fracturing, and most chemicals used in fracking have never been assessed for potential threat.**

Similarly, members of the public cannot access any information about the environmental conditions placed on gas fracking projects, including compliance with any conditions that may be in place. Under the *WA Petroleum and Geothermal Act 1967*, a proponent is required to have an Environmental Management Plan (EMP) which is assessed by the DMP. This EMP is not legally enforceable and the DMP will not release the EMP's to the public.

Entry onto private land for exploration and production can be undertaken only after either the landowner has given written consent, or compensation (if any) has been agreed with the landowner. If compensation cannot be agreed, either party may refer the matter to the Local Court.<sup>34</sup> However, private landholders cannot stop companies being issued exploration licences which cover their land.

# MORATORIUM NOW!

**Gas fracking has already been blanket banned in France and some states of the US. In January 2012, Belgium also banned fracking for petroleum both onshore and offshore, some of Belgium's gas bearing formations occur at depths equal to and deeper than Western Australia. Moratoriums exist for unconventional gas activities in NSW, across Europe, South Africa, and various states of the US.**

The Wilderness Society (WA) and the Conservation Council of WA are calling on the WA Government to place an immediate moratorium on gas fracking in WA until EPA assessments and enforceable regulations can guarantee these activities will not have any adverse impacts on WA's environment, food production or public health, and will not result in any contamination of groundwater aquifers.

The following minimum standards must apply before any gas fracking activities are allowed to take place in WA:

- A requirement for full public disclosure and rigorous independent testing of all chemicals before they are used, to demonstrate that drilling and fracking operations will have no adverse impacts on groundwater, human health and the environment;
- Rigorous independent assessment of hydrogeology, including aquifer connectivity and groundwater level and quality prior to any drilling in a project area;
- Independent testing and modelling of faulting, stress-fields and any other geological features that can influence the direction and depth of the fractures, fluid migration and hydrocarbon migration from project activities;
- Independent assessment of the cumulative impact of gas fracking proposals (including surface operations, groundwater impacts and carbon pollution) to demonstrate that the activities will not have an adverse impact on WA's unique ecosystems or agricultural lands;
- Public release of all other information relating to environmental management and compliance by the fracking industry, including proponent documentation, management plans, compliance reports and groundwater and environmental monitoring data;
- Any liability for contamination of lands, groundwater, or other community assets, or greenhouse emissions due to methane leakage, to be borne by the company conducting the operations rather than the State and people of Western Australia;
- Private and Indigenous landholders to have a legal veto to prevent gas fracking activities occurring on or beneath their lands.
- No reduction of groundwater levels or quality as a result of water use in gas fracking operations
- No uncontrolled methane leakage from drilled locations, wellheads or bore-fields
- No reduction in available agricultural land in WA.

## TAKE ACTION

**You can add your name to support a moratorium on gas fracking in WA by visiting <http://ccwa.org.au/takeaction>**

## FOR MORE INFORMATION

- Email Wilderness Society: [wa@wilderness.org.au](mailto:wa@wilderness.org.au)
- Email Conservation Council of WA: [conswa@conservationwa.asn.au](mailto:conswa@conservationwa.asn.au) or [www.ccwa.org.au](http://www.ccwa.org.au)
- Alison Xamon MLC factsheets: <http://www.alisonxamon.org.au/unconventional-gas-and-fracking>
- 'Lock the Gate Alliance' factsheets: <http://lockthegate.org.au/documents/#Fact%20Sheets>
- Environmental Defenders Office factsheets: <http://edowa.org.au/discover/factsheets/>
- Department of Mines and Petroleum (DMP) Newsletter: <http://dmp.wa.gov.au/documents/000363.jemma.williams.pdf>
- DMP Petroleum titles Map (Current July 2011): <http://www.dmp.wa.gov.au/documents/PD-PTLA-ADM-148D%285%29.pdf>

**Your local member of parliament (to write to or phone):**

<http://www.parliament.wa.gov.au/web/newwebpar.nsf/iframewebpages/Legislative+Assembly+-+Current+Members>



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