

## **Submission to the Inquiry into Hydraulic Fracturing in the Northern Territory**

Lock the Gate Alliance is a national grassroots organisation made up of thousands of individuals and over 160 local groups who are concerned about unsafe mining practices, and particularly unconventional gas extraction. The mission of the Lock the Gate Alliance is to protect Australia's agricultural, environmental and cultural resources from inappropriate mining and to educate and empower all Australians to demand sustainable solutions to food and energy production. Lock the Gate Alliance is committed to advocating that community health and rural industries should take priority over the development of an unconventional gas industry in Australia.

Lock the Gate Alliance welcomes the opportunity to make a submission to this Inquiry. However, the Alliance notes that the designated Terms of Reference for the Inquiry fall a long way short of a thorough investigation into the range of issues surrounding the unconventional gas (UG) industry in general and the process of hydraulic fracturing in particular. In addition the Terms of Reference seem inordinately geared towards the assumption that any environmental impacts of fracking can be managed and mitigated prior to any proper consideration and thorough assessment of those risks and impacts. Prior to any further expansion in this industry in the Northern Territory, Lock the Gate recommends that the NT Parliament instigate a comprehensive, rigorous and independent scientific investigation of the potential impacts of UG development on the land, water and communities of the Northern Territory. Any inquiry should include investigation of impacts on health, water resources, land use, air quality and fugitive emissions, and address, at a minimum:

- Risks of contamination and depletion of ground and surface water resources from fracking and UG extraction methods
- Risks to human health from hazardous air pollutants and water contamination
- Social and cultural impacts of gas field development
- Impacts on cultural heritage,
- Impacts on biodiversity and natural areas
- Lack of existing baseline data by which to measure impacts
- Cumulative impacts of gas field development

Further to this, the Alliance strongly urges the NT parliament to implement a moratorium on the expansion of this industry until such time as this scientific investigation is undertaken and the risks are fully quantified and a proper risk based assessment is undertaken in deciding whether the industry should proceed, and if so, in what areas. The Alliance also recommends that the NT government implement standards for mandatory baseline monitoring of health impacts, water resources, air quality, soil quality and fugitive emissions prior to any further development of the UG industry in the state.

Notwithstanding the limitations in the current Terms of Reference (TOR) and the recommendations referred to above, Lock the Gate offers the following response to the current Northern Territory Fracking Inquiry.

## **TOR: Frequency of types and causes of environmental impacts from hydraulic fracturing for hydrocarbon deposits in the Northern Territory and for similar deposits in other parts of the world.**

After two and a half decades of rapid development and large-scale expansion in the unconventional gas (UG) industry in the United States, there is now a growing body of literature worldwide on the negative impacts of the processes and practices involved in the exploration and production of unconventional gas, particularly the process of hydraulic fracturing (fracking). The Australian Council of Learned Academies<sup>1</sup> notes: "Because of the manner in which shale gas is produced it has the potential to impact on the landscape, on ecosystems, on surface and groundwater, on the atmosphere, on communities, and rarely may result in minor induced seismicity." A number of comprehensive investigative reports by various European authorities and expert bodies also identify and document a wide range of issues with UG development and fracking that present a high risk for people and the environment. These studies include:

1. *Support to the identification of potential risks for the environment and human health arising from hydrocarbons operations involving hydraulic fracturing in Europe, European Commission: DG Environment (August 2012).*<sup>2</sup>
2. *Hydrofracking Risk Assessment, Study concerning the safety and environmental compatibility of hydrofracking for natural gas production from unconventional reservoirs, Panel of experts.*<sup>3</sup>
3. *Impacts of Shale Gas and Shale Oil on the Environment and Human Health, Directorate General for the Internal Policies, Policy Department: Economic and Scientific Policy, European Parliament.*<sup>4</sup>

### **Impacts on water resources**

The impacts of UG development on water resources will negatively impact the current and future use of land due to the likely reduction in the quantity and quality of water available for other land uses. This would have negative impacts on the NT's pastoral industry, commercial and recreational fisheries, rural and residential water supplies, and natural ecosystems. Impacts on groundwater resources are particularly relevant to the Northern Territory context where groundwater is the lifeblood of the Territory and both human activity and natural ecosystems are dependent on and interact with groundwater. It is also of great concern where the areas currently targeted for UG extraction coincide with important groundwater resources, such as in the areas around Alice Springs where aquifers vital for all residential and industrial use in the township occur. As the National Water Commission notes: "The lack of integration of planning and management of water for mining operations with that for other purposes in the NT has the potential to compromise water security for consumptive users and the environment if mining or petroleum activities expand into areas of high water use."<sup>5</sup>

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<sup>1</sup> Engineering Energy: Unconventional Gas Production, ACOLA

<sup>2</sup> <http://ec.europa.eu/environment/integration/energy/pdf/fracking%20study.pdf>

<sup>3</sup> [http://dialog-erdgasundfrac.de/sites/dialog-erdgasundfrac.de/files/Ex\\_HydrofrackingRiskAssessment\\_120611.pdf](http://dialog-erdgasundfrac.de/sites/dialog-erdgasundfrac.de/files/Ex_HydrofrackingRiskAssessment_120611.pdf)

<sup>4</sup> <http://www.europarl.europa.eu/document/activities/cont/201107/20110715ATT24183/20110715ATT24183EN.pdf>

<sup>5</sup> NWC Planning Report: NT: [http://archive.nwc.gov.au/\\_\\_data/assets/pdf\\_file/0004/19840/11213\\_NWC\\_Planning\\_Report\\_NT\\_web.pdf](http://archive.nwc.gov.au/__data/assets/pdf_file/0004/19840/11213_NWC_Planning_Report_NT_web.pdf)

These water impacts include:

**Depletion of ground and surface water resources due to the large amount of water required in fracking processes, the many times wells are fracked, and the massive number of wells needed to develop unconventional resources:**

Fracking is an extremely water-intensive practice. The Australian gas industry provides a figure of 11 million litres per shale or tight gas frack<sup>6</sup>, however a range of other sources suggest that water use is often much higher<sup>7</sup>. According to one UN report, a single frack operation on a shale gas well will use between 11 and 34 million litres of water, roughly 360 – 1100 truckloads<sup>8</sup>. Wells are often fracked on multiple occasions, sometimes up to ten times<sup>9</sup>, thereby multiplying the water use. Significant amounts of water are also used in drilling processes (around 1 million litres per well<sup>10</sup>). In the US, towns and pastoral properties that must compete with fracking operators for scarce water supplies have been seriously affected. In Texas, extraction of water for fracking has contributed to serious problems of ground and surface water depletion during drought conditions<sup>11</sup>.

**Impacts resulting from the large amounts of chemicals required in each fracking operation and toxicity of these chemicals and release of these into ground and surface water systems and soils:**

The gas industry is at pains to point out that chemical additives make up only a very small proportion of fracking fluids- ‘approximately’ .5%<sup>12</sup>. In reality, the amounts used range from .5 to 2%<sup>13</sup>, and while this is a small proportion relative to the large volumes of water used, it translates to very large quantities of chemical additives. For example, a typical 15 million litre fracturing operation would use from 80 to 330 tons of chemicals<sup>14</sup>. Industry also maintains that ‘most’ of these chemicals are found in household products<sup>15</sup>. In actuality, fracking compounds used in Australia have been shown to include many hazardous substances, including carcinogens, neurotoxins, irritants/sensitisers, reproductive toxins and endocrine disruptors<sup>16</sup>. Many of the chemicals used in fracking have never been assessed for their long-term impacts on the environment and human health.

**Contamination of ground and surface water resources with fracking fluids and flow back:**

According to industry sources, after each fracking operation, around 30% of the fracking fluid flows back to the surface<sup>17</sup>. However, recent reports suggest as little as 6-8% may be recovered<sup>18</sup>. ‘Produced’ water, underground water in or near the drilling area, can also come to

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<sup>6</sup> APPEA: The Natural Gas Revolution- Natural gas from shale and tight rocks.

<sup>7</sup> Kargbo D, William R & Campbell D, (2010) Natural Gas Plays in the Marcellus Shale: Challenges and Potential Opportunities, Vol. 44, No. 15 *Environmental Science & Technology*; CIWEM UK, 2012 Policy Position Statement ‘Hydraulic Fracturing (Fracking) of Shale in the UK’;

<sup>8</sup> UNEP Global Environmental Alert Service: *Gas Fracking: Can we safely squeeze the rocks?*

<sup>9</sup> European Parliament, Economic & Scientific Policy Dept, *Impacts of shale gas and shale oil extraction on the environment and on human health*.

<sup>10</sup> WA Govt: *Natural gas from shale & gas fact sheet: water use & management*.

<sup>11</sup> *Frackers guzzle water as Texas goes thirsty*: <http://nation.time.com/2013/09/29/frackers-guzzle-water-as-texas-goes-thirsty/>; Western Organization of Resource Councils: *Watered Down: Oil & gas production & oversight in the west*.

<sup>12</sup> APPEA: The Natural Gas Revolution- Natural gas from shale and tight rocks.

<sup>13</sup> Hazen and Sawyer, December 22, 2009. Impact Assessment of Natural Gas Production in the New York City Water Supply Watershed.

<sup>14</sup> Ibid

<sup>15</sup> APPEA: The Natural Gas Revolution- Natural gas from shale and tight rocks.

<sup>16</sup> National Toxics Network: *Toxic Chemicals in the Exploration and Production of Gas from Unconventional Sources*.

<sup>17</sup> APPEA: The Natural Gas Revolution- Natural gas from shale and tight rocks.

<sup>18</sup> Hansen, Mulvaney & Betcher, *Water resources reporting and water footprint from Marcellus Shale development in West Virginia & Pennsylvania*

the surface during gas production. For a typical shale gas well, daily produced water volumes range from 300 – 4,500 litres<sup>19</sup>. In addition to the chemicals used in drilling and fracking, flowback and produced water can contain a range of naturally occurring substances from the source rock. These contaminants include, heavy metals, naturally occurring radioactive materials (NORMs - including Radium, Thorium and Uranium), volatile and semi volatile organic compounds (VOC's) and high concentrations of salts<sup>20</sup>. The safe disposal of this wastewater poses serious problems. The large volumes of waste water produced from shale gas mining are likely to be reinjected into aquifer formations, partially 'treated' and reused or released into waterways, or trucked to holding ponds for storage and 'evaporation'<sup>21</sup>.

Aquifer cross-contamination with introduced or naturally occurring toxic substances may occur through migration of fluids via natural pathways in underground geologies, via pathways created by the fracking process or as a result of well blow outs and well casing failings (which industry documents show occur in a significant number of wells<sup>22</sup>).<sup>23</sup> US studies have implicated shale gas in the contamination of groundwater with heavy metals, salts and gas<sup>24</sup>. Contamination can occur from well casing failure due to corrosion, faulty construction or repeated fracturing. Data from one US state shows that 6-7% of new shale gas wells were faulty and leaking gas<sup>25</sup>. After 20 years this failure rate may increase to 50%, as wells corrode and cement casings degrade<sup>26</sup>. Recent research from the USA found higher levels of arsenic and other heavy metals, plus higher salinity, in water bores which were less than 3km from shale gas wells<sup>27</sup>. Other research has found increased methane concentrations in water bores closer to shale gas wells, creating an explosion hazard<sup>28</sup>.

The large volumes (tens of thousands of litres per well) of hazardous flow back fluid (15 - 80% of the hydraulic fluid mixture that returns to the surface<sup>29</sup>) must be stored and disposed of after fracking at each well. Contamination of surface water and shallow aquifers may occur from release of insufficiently treated or untreated wastewater onto land surfaces or directly into waterways and as a result of leakage from storage facilities. Surface water contamination may also occur from accidental spills of fracking fluids or solids at the surface and via surface well blow outs.<sup>30 31</sup> This is of particular concern in the NT where a number of river systems are in a near-pristine condition, and require careful management to ensure their natural values are protected.

The European Report, "*Support to the identification of potential risks for the environment and human health arising from hydrocarbons operations involving hydraulic fracturing in Europe*", states that there is a moderate-high risk of both ground and surface water contamination from both single frack

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<sup>19</sup> Bill Chameides, "Natural Gas, Hydrofracking and Safety: The Three Faces of Fracking Water," National Geographic, September 20, 2011.

<sup>20</sup> Ibid

<sup>21</sup> National Toxics Network: *Toxic Chemicals in the Exploration and Production of Gas from Unconventional Sources*.

<sup>22</sup> [http://www1.rollingstone.com/extras/theskyispink\\_annotdoc-gasl4final.pdf](http://www1.rollingstone.com/extras/theskyispink_annotdoc-gasl4final.pdf)

<sup>23</sup> NTN: Toxic Chemicals in the Exploration and Production of Gas from Unconventional Sources

<sup>24</sup> Fracking: The evidence, <https://docs.google.com/file/d/0B1cEvov1OlyHdzRBRjk4dElfbVE/edit?pli=1>

<sup>25</sup> Ibid

<sup>26</sup> *Marcellus Shale Exposed*, Antony Ingraffea, <http://www.youtube.com/watch?v=7DK3fODCZ3w>; ANTHONY R. INGRAFFEA, PH.D., P.E., *FLUID MIGRATION MECHANISMS DUE TO FAULTY WELL DESIGN AND/OR CONSTRUCTION*.

<sup>27</sup> Fontenot et al 2013, An Evaluation of Water Quality in Private Drinking Water Wells near Natural Gas Extraction Sites in the Barnett Shale Formation. *Environ. Sci. Technol.* 2013. 47 (17) pp 10032-10040

<sup>28</sup> Osborn et al 2013. *Methane contamination of drinking water accompanying gas-well drilling and hydraulic fracturing*. PNAS, May 17 2011.

<sup>29</sup> [http://www.karooplaces.com/wp-content/uploads/2011/06/coop\\_shale\\_gas\\_report\\_final\\_200111.pdf](http://www.karooplaces.com/wp-content/uploads/2011/06/coop_shale_gas_report_final_200111.pdf)

<sup>30</sup> NTN: Toxic Chemicals in the Exploration and Production of Gas from Unconventional Sources; [http://www.karooplaces.com/wp-content/uploads/2011/06/coop\\_shale\\_gas\\_report\\_final\\_200111.pdf](http://www.karooplaces.com/wp-content/uploads/2011/06/coop_shale_gas_report_final_200111.pdf)

<sup>31</sup> Fracking: a serious concern for surface water as well as groundwater:

<http://ec.europa.eu/environment/integration/research/newsalert/pdf/275na3.pdf>

operations and cumulative fracking operations, and a high risk to water resources from cumulative fracking operations<sup>32</sup>. For multiple examples of water contamination and depletion from hydraulic fracturing processes see: “*Brief Review of Threats to Canada’s Groundwater from the Oil and Gas Industries’ Methane Migration and Hydraulic Fracturing*”, Ernst Environmental Services.<sup>33</sup> There is also ever-increasing evidence available from across the US of significant depletion and contamination of water resources and waste management issues from unconventional gas operations<sup>34</sup>.

### Impacts on cultural and natural values

Many of the areas currently targeted for gas exploration in the NT support some of Australia’s most stunning natural and cultural environments and there is significant concern about the impact of UG extraction and fracking operations on these values. If UG development takes place in areas such as Arnhem Land, the Gulf Region and the semi-arid regions of Central Australia, where they are currently proposed, there are likely to be very significant impacts on the cultural heritage values and important cultural sites in these areas.

The impacts of UG extraction and fracking on the natural values of the NT, including native vegetation, wildlife habitat and biodiversity, include<sup>35 36</sup>:

- Destruction and fragmentation of critical wildlife habitat and food resources for construction of roads, pipelines and well pads.
- Wildlife deaths from large numbers of heavy traffic movements and exposure to wastewater via leaks spills or in holding ponds.
- Depletion and contamination of ground and water supplies represent a major threat to the vegetation, natural ecosystems, wildlife, groundwater dependent organisms, and wetland areas that rely on those water resources.
- Invasion by noxious weeds as well as feral pests and predators.
- Increased bushfire risk due to increases in ignition sources and flammable fuel for fires.
- Fouling of natural waterways from vegetation clearing and sediment run off from pads, pipelines and roads as well as wastewater releases into waterways.
- Disruption to wildlife by machinery, traffic and drilling noise and emissions.

In assessing the rehabilitation of land that has been hydraulically fractured, the European Commission report<sup>37</sup> on fracking notes: “The evidence suggests that it may not be possible fully to restore sites in sensitive areas following well completion or abandonment, particularly in areas of high agricultural,

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<sup>32</sup> <http://ec.europa.eu/environment/integration/energy/pdf/fracking%20study.pdf>

<sup>33</sup> <http://www.ernstversusencana.ca/wp-content/uploads/2013/06/Brief-review-of-threats-to-Canadas-groundwater-from-oil-gas-industrys-methane-migration-and-hydraulic-fracturing-v4.pdf>

<sup>34</sup> Western Organization of Resource Councils: *Watered Down: Oil & gas production & oversight in the wes; Fracking: the evidence*, <https://docs.google.com/file/d/0B1cEvov1OlyHdzRBRik4dElfbVE/edit?pli=1>; Hansen, Mulvaney & Betcher, *Water resources reporting and water footprint from Marcellus Shale development in West Virginia & Pennsylvania*.

<sup>35</sup> Engineering Energy: Unconventional Gas Production, ACOLA

<sup>36</sup> *Support to the identification of potential risks for the environment and human health arising from hydrocarbons operations involving hydraulic fracturing in Europe*, European Commission: DG Environment (August 2012)

<sup>37</sup> *Support to the identification of potential risks for the environment and human health arising from hydrocarbons operations involving hydraulic fracturing in Europe*, European Commission: DG Environment (August 2012)

natural or cultural value. Over a wider area, with multiple installations, this could result in a significant loss or fragmentation of amenities or recreational facilities, valuable farmland or natural habitats.”

Given the spatial intensity of UG fields and the number of large multi-well pads and road and pipeline corridors required, there is likely to be a very significant total land area that is rendered unusable for other purposes as a result of fracking operations. The scars on the landscape from UG developments are likely to remain indefinitely, particularly in arid and semi-arid regions, and will permanently destroy the visual amenity of these regions. This is of particular concern in high tourism value areas of the Northern Territory.

If unconventional gas exploration and eventually production is allowed to take place across large parts of the Northern Territory as is currently proposed- with 90% of the Territory covered in licences and applications- then the tourism, cultural and nature based industries in the NT’s iconic locations are likely to be negatively impacted. Lock the Gate maintains that it is entirely inappropriate for UG development and fracking to take place on the Northern Territory’s conservation estate and on and surrounding areas of significant natural and cultural value where exploration is currently proposed including: Watarrka (Kings Canon) National Park, the areas surrounding Uluru - Kata Tjuta National Park and in Arnhem Land.

### **Impacts on rural communities**

The impacts of fracking on current and future uses of land cannot be considered in isolation from the communities that live in the rural regions of the NT where fracking operations are proposed and who undertake the land use activities and rural industries that currently exist in those regions and would be impacted by the UG industry. There are a number of very significant impacts on communities across Australia and the US facing and experiencing the rapid industrialization of their region from UG development. These impacts are outlined in the following paragraphs. Planning for expansion of the gas industry in the Northern Territory needs to be cognisant of Indigenous cultural values with over half of the Territory being Aboriginal land and Aboriginal people comprising approximately 30 per cent of the population. It is likely that a rapid and significant expansion in the industry as is being promoted by the current NT government will have significantly impact on the cultural and tourism industries these communities are currently involved with.

Exposure to toxic fracking chemicals and byproducts of the fracking process via air pollution and water contamination pose a serious threat to human health. Exposure to hazardous air pollutants is a serious health hazard for those living adjacent to or surrounded by UG fields. A recent report<sup>38</sup> from the US based [Centre for Environmental Health](#) states that “all around the country people are finding that hydraulic fracturing [ ] is dangerous, destructive, and harmful to human health. Contaminated water and harmful air pollution are just a few of the all-too-real side effects associated with unconventional oil and natural gas development. Pregnant women, mothers, and their babies are at particular risk from toxic chemical exposures that can lead to infertility, miscarriage, impaired learning and intellectual development, birth defects, respiratory problems, heart disease, and cancer.”

Hazardous air pollutants are released as part of fracking operations from the burning of diesel in machinery, generators and vehicles, off-gassing from wastewater ponds, flaring and venting at

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<sup>38</sup> [Toxic and Dirty Secrets: The Truth About Fracking and Your Family’s Health](#),

wellheads, plus leaks and emissions from wells, pipelines and compressor stations.<sup>39</sup> A 2012 study detected 44 hazardous air pollutants at gas drilling sites and several other US studies highlight the health symptoms experienced by those living near drilling operations<sup>40</sup>. Exposure to harmful substances can also occur through direct skin contact with the chemicals or wastes; drinking or bathing in contaminated water and through contaminated dust particulates<sup>41</sup>. Communities living near gasfields in the US have reported serious health effects following the commencement of unconventional gas operations<sup>42</sup>. These conditions include serious respiratory ailments, nose throat and eye irritations and neurological illnesses<sup>43</sup>.

The social stressors associated with the heavy industrial activities that accompany UG development also take a heavy toll on the mental and emotional health of rural families and communities impacted by UG development. "Fracking has also been found to detrimentally impact the immediate and nearby communities. Fracking increases traffic and creates industrial noise, which is correlated with hypertension, sleep disturbance, cardiovascular disease and stroke. Because of the many health problems associated with fracking, the process also strains the communities' health care resources."<sup>44</sup> Doctors for the Environment Australia (DEA) has written extensively on the issues of unconventional gas and health. DEA's "Gas as a replacement fuel: Discussion paper on the health aspects of gas" can be found at: [http://dea.org.au/images/general/Gas\\_and\\_Health\\_Report\\_01](http://dea.org.au/images/general/Gas_and_Health_Report_01).

The DEA states: "Large scale coal seam gas development poses poorly assessed, yet potentially serious health risks to the community. There is the potential for public health to be affected directly and indirectly by CSG operations through contamination of water, air and soil, as well as long-term impacts on rural communities. Current assessment, regulation and monitoring of CSG impacts on the environment, public health and vulnerable communities is insufficient to provide confidence of adequate safeguards."<sup>45</sup> Where it occurs in areas of human habitation, the health and community impacts of the proposed shale and tight gas industry in WA are likely to be similar to those of the rapidly expanding east coast CSG industry as the majority of the processes and practices involved in CSG development are mirrored in other forms of UG development - in particular the scale and level of intensity of the heavy industrial operations involved. DEA also note that "Water and air pollution, water shortages, permanent degradation of productive agricultural land and loss of livelihood and landscape...all have mental health consequences for communities living in a gas field."<sup>46</sup>

In discussing the broader social impacts of UG development, DEA note: "Informed consent of landholders is often lacking in the contract process when mining companies first approach landholders about unconventional gas extraction.... The injustice and powerlessness that this engenders contributes to solastalgia and poorer mental health outcomes." The lack of a veto right for landholders in relation to UG development, the stress involved in dealing with UG companies (often against their will), the lack of full information and disclosure on the realities of UG development, and the often underhanded tactics

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<sup>39</sup> NTN: Toxic Chemicals in the Exploration and Production of Gas from Unconventional Sources

<sup>40</sup> NTN: Toxic Chemicals in the Exploration and Production of Gas from Unconventional Sources

<sup>41</sup> NTN: Toxic Chemicals in the Exploration and Production of Gas from Unconventional Sources

<sup>42</sup> Centre for Environmental Health: [Toxic and Dirty Secrets: The Truth about Fracking and Your Family's Health](#).

<sup>43</sup> National Toxics Network: *Toxic Chemicals in the Exploration and Production of Gas from Unconventional Sources*.

<sup>44</sup> [Toxic and Dirty Secrets: The Truth About Fracking and Your Family's Health](#),

<sup>45</sup> [http://dea.org.au/images/general/viewpoint\\_issue\\_8\\_CSG.pdf](http://dea.org.au/images/general/viewpoint_issue_8_CSG.pdf)

<sup>46</sup> DEA, Submission to the Inquiry into Coal Seam Gas, 16/09/2011

employed by companies contributes to a sense of powerlessness, betrayal and frustration amongst landholders and affected communities. According to DEA, in eastern Australia, “The stress and disruption caused to farmers has already been shown to force some of them to leave a CSG drilling area, allowing once productive lands to lapse into disuse,” whilst in the US “long time residents are moving, unable to bear the changes the gas industry has wrought on their landscape and community.”

The health and social impacts of UG development will necessarily have a flow on negative impact on the overall wellbeing of rural communities as well as the functionality of the industries in which rural residents are engaged. This impact will be magnified due to the fact that farming and rural communities are the very same communities who are already at most risk from the adverse health effects of drought, climate change and the degradation and depletion of Australia’s river systems and groundwater resources.<sup>47</sup>

Lock the Gate members and local community groups report a range of impacts from proposed and actual UG development on their mental and emotional wellbeing. These include:

- A sense of injustice that they do not have the right to refuse access to companies for UG activities and that this industry is being forced on an unwilling population.
- Fear and anxiety about the impacts of the UG industry on their family’s health and the quality of the air and water they rely upon.
- Concern about the impact of UG development on the economic viability of their farms and property values.
- A sense of anger and betrayal that governments are supporting industry rather than communities in the development of the UG industry.
- A sense of anger that the industry is being pushed ahead rapidly without proper consideration of the impacts and before proper scientific studies have been done and baseline data collected.

The East Coast experience has shown that when this industry is forced upon communities against their wishes there is potential for significant conflict and social upheaval and disruption as a result.

DEA<sup>48</sup> also note that there are likely to be negative economic impacts on existing rural industries, social divisions and negative mental and physical health consequences for rural communities from the economic realities of UG development. These economic impacts include:

- The use of fly-in/fly-out (FIFO) workers in UG operations rather than local workforces.
- Increases in rent and costs of goods and services as a result of UG industry development.

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<sup>47</sup> DEA, Submission to the Inquiry into Coal Seam Gas, 16/09/2011

<sup>48</sup> DEA, Submission to the Inquiry into Coal Seam Gas, 16/09/2011

- Loss of workers is local businesses, particularly agricultural enterprises, who are unable to compete for skilled labour with the wages offered by UG companies.
- Decreased land values in proximity to gas field development.

Overall, DEA maintain that UG development can “divide previously close-knit rural communities, increasing tension and disharmony.”

In the case of Indigenous communities in the NT, these community impacts are likely to be further complicated and compounded by a range of cultural factors, language differences and economic and political inequalities. Central to this, Lock the Gate maintains that in any consultation/negotiation processes between Indigenous land holding groups and gas companies about access for gas exploration and extraction, Indigenous stakeholders must have adequate access to culturally appropriate and accessible information about the full scale of eventual gas developments on their lands and be fully informed about the risks and potential impacts of these developments. This information would need to be sourced from an independent source as it is clear from industry and government presentations and literature in the NT to date<sup>49</sup>, that the risks and impacts of the industry are not being presented adequately.

**TOR: The potential for regional and area variations of the risk of environmental impacts from hydraulic fracturing in the Northern Territory.**

As the National Water Commission notes: “The Northern Territory experiences a wide range of climatic conditions ranging from the arid centre to the pronounced wet and dry seasons in the north. In the top one-third of the Territory, water is extracted for consumptive uses from a mixture of both surface water and groundwater resources, with reliance on groundwater during the dry season. In the lower two-thirds of the Northern Territory, surface water flows are highly sporadic and there is a greater reliance on groundwater for consumptive uses.”

The wide range of climatic conditions across the NT means that the land use and water impacts of fracking and UG extraction will vary considerably in different parts of the Territory. In general, as all parts of the Territory rely to varying extent on groundwater resources, any depletion or contamination of these resources will have impacts on other water users. In areas of high water use and greater groundwater dependence, the competing demands for water between the gas industry and other users is likely to be significant. The National Water Commission notes that: “the licencing provisions of the [NT] Water Act do not apply to mining and petroleum activities, including associated exploration activities.”<sup>50</sup> Given that “the extraction of, or interference with, water from [petroleum] activities is authorized under separate legislation,” Lock the Gate is concerned that there is currently inadequate provision for protecting the needs of other NT water users and the environment where there is competition with the very large water use requirements of fracking operations. In the drier southern sections of the NT, the complete reliance on groundwater for pastoral, residential and industrial use means that any competition for water between existing users and fracking operations would be

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<sup>49</sup> APPEA: The Natural Gas Revolution- Natural gas from shale and tight rocks.

<sup>50</sup> NWC Planning Report: NT: [http://archive.nwc.gov.au/\\_\\_data/assets/pdf\\_file/0004/19840/11213\\_NWC\\_Planning\\_Report\\_NT\\_web.pdf](http://archive.nwc.gov.au/__data/assets/pdf_file/0004/19840/11213_NWC_Planning_Report_NT_web.pdf)

accentuated. Lock the Gate maintains that there is currently inadequate understanding of the groundwater systems of much of the Territory and the full impacts of future water use for unconventional gas production fields is therefore impossible to properly quantify and assess, let alone mitigate and manage.

In the monsoonal environments of the NT, the contamination of soils and waterways with toxic wastewater from fracking and UG operations during high rainfall and flood events as a result of overflows from holding ponds, accidental or planned release of wastewater into natural waterways and seepage, spills or accidents is of considerable concern. The mining industry in the NT already has many examples of contamination as a result of leaking tailings dams, failed wastewater containment systems and contaminated run off from mining sites.<sup>5152</sup> The prospect of massive quantities of wastewater from fracking operations needing to be stored, transported, treated and disposed of, poses a very grave threat to the river systems of the Top End - in particular those river systems that are in a near-pristine condition and require careful management to ensure their natural values are protected. Much of the vast area currently under petroleum licence or application in the Top End of the NT is crisscrossed with extensive river, estuarine and wetlands systems that would be severely impacted by large scale implementation of unconventional gasfields, particularly during the wet season. The construction of roads, pipelines, and other gas infrastructure would also have significant impacts on water flow across the landscape during the monsoon.

Given that many of the Territory's natural environments can be classified as "sensitive" and that "evidence suggests that it may not be possible fully to restore sites in sensitive areas following well completion or abandonment", Lock the Gate has grave concerns about the long term legacy of a short term unconventional gas industry on the natural and cultural landscapes and environments of the Territory. Given the spatial intensity of well pads and infrastructure in unconventional gasfields, and the required size and scale of commercial UG projects, the amount of area of the Territory impacted by large scale UG production in the NT could be vast. This level of disturbance is unprecedented in the history of NT and dwarfs the scale of any current mining and industrial operations.

If UG development proceeds alongside pastoral operations there is the risk of health impacts on cattle. A 2012 case study in the US found serious evidence of harm to domestic stock from shale gas drilling waste contamination, including cattle deaths, stillbirths and reproductive problems<sup>53</sup>. There is also the risk of contamination of beef with chemicals which would have a significant impact on potential sale of beef products. This issue is a concern to beef producers living alongside coal seam gas operations in Queensland<sup>54</sup>.

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<sup>51</sup> <http://www.ntepa.nt.gov.au/news/2013/legacy-mining-issues-at-redbank>

<sup>52</sup> <http://www.theage.com.au/national/polluted-water-leaking-into-kakadu-from-uranium-mine-20090312-8whw.html>

<sup>53</sup> MICHELLE BAMBERGER, ROBERT E. OSWALD, *IMPACTS OF GAS DRILLING ON HUMAN AND ANIMAL HEALTH*.

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[http://www.beefcentral.com/news/article/4428?utm\\_medium=email&utm\\_campaign=Beef+Central+news+headlines+24+March+2014&utm\\_content=Beef+Central+news+headlines+24+March+2014+CID\\_b5031d2795fcfed5f577a7125e37366f&utm\\_source=eGenerator&utm\\_term=click%20here](http://www.beefcentral.com/news/article/4428?utm_medium=email&utm_campaign=Beef+Central+news+headlines+24+March+2014&utm_content=Beef+Central+news+headlines+24+March+2014+CID_b5031d2795fcfed5f577a7125e37366f&utm_source=eGenerator&utm_term=click%20here)

**TOR: Effective methods for mitigating potential environment impacts before, during and after hydraulic fracturing with reference to:**

- **the selection of sites for wells**
- **well design, construction, standards, control and operational safety and well integrity ratings**
- **water use**
- **chemical use**
- **disposal and treatment of waste water and drilling muds**
- **fugitive emissions**
- **noise**
- **monitoring requirements**
- **the use of single or multiple well pads**
- **rehabilitation and closure of wells (exploratory and production) including issues associated with corrosion and long term post closure**
- **site rehabilitation for areas where hydraulic fracturing activities have occurred.**

The banner of the NT Department of Resources website reads: *“The Territory is fortunate to have some of Australia’s most beautiful natural places, some of the least disturbed environments in the world and some extraordinary wildlife.”* The tourism industry in the NT is largely based around the natural values of the Territory - the extensive, pristine waterways and lush natural environment of the Top End; the unusually rich numbers of species, concentrations of threatened species or species not found anywhere else; “the vast ochre deserts, spectacular skies, surreal rocky outcrops and deep, snaking canyons of [the] sparse and iconic landscape”<sup>55</sup> of the Outback. This image of the NT would be irreversibly changed by large scale unconventional gas production over significant areas of the Territory.

Lock the Gate maintains that an effective framework for mitigation of any potential impacts from fracking and UG development must be implemented prior to operations commencing and that any such framework requires three key components:

1. There should not be any unconventional gas drilling until there have been proper studies assessing the impacts and providing guarantees that operations will not cause harm to land and water resources and the health of communities.
2. There must be proper regulations in place to ensure the protection of the environment and the inclusion of communities in decision-making processes.
3. If unconventional gas operations go ahead there must be strict exclusion zones in place to protect food producing land, important water resources, cultural heritage sites, tourism icons and residential areas.

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<sup>55</sup> <http://www.travelnt.com/en/Things-to-do/Nature-and-wildlife/The-Outback.aspx>