Fact Sheet – Shale and Tight Gas Extraction

Shale and tight gas are two types of unconventional gas now being targeted in Australia. Shale gas is found in shale rocks, whilst tight gas is found in low permeability sandstone rocks.

Shale and tight gasfields involve the industrialisation of entire landscapes with numerous closely spaced wells. Typical gasfields contain thousands of wells. Gasfields also require vast networks of access roads, gas pipelines, compressor stations, processing plants, and wastewater holding dams and treatment plants.

Techniques such as horizontal drilling and hydraulic fracturing (fracking) are needed to extract commercial quantities of shale and tight gas. Fracking involves pumping large volumes of water, chemicals and sand (or other 'proppants') into the ground to 'stimulate' gas flow. Tight gas also requires acidation, which involves pumping acids into the well to dissolve the cements between rock grains.

Whilst the gas industry maintains that unconventional gas extraction is safe and 'clean', there is a growing body of research from overseas that highlights the impacts of shale and tight gas operations on land, water and human health.

Shale and tight gas mining processes require vast amounts of water

- Fracking is an extremely water-intensive practice. The Australian gas industry provides a figure of 11 million litres per shale or tight gas frack[1], however a range of other sources suggest that water use is often much higher[2]. 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[3].
- Wells are often fracked on multiple occasions, sometimes up to ten times[4], thereby multiplying the water use. Significant amounts of water are also used in drilling processes (around 1 million litres per well[5]).
- In the US, towns and pastoral properties that must compete with fracking operators for scarce water supplies have been seriously affected. Texas, extraction of water for fracking has contributed to serious problems of ground and surface water depletion during drought conditions[6].

Shale and tight gas mining uses large amounts of chemicals in each fracking operation

- The gas industry is at pains to point out that chemical additives make up only a very small proportion of fracking fluids- 'approximately' .5%[7]. In reality, the amounts used range from .5 to 2%[8], 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[9].
- Industry also maintains that 'most' of these chemicals are found in household products[10]. 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[11]. Many of the chemicals used in fracking have never been assessed for their long-term impacts on the environment and human health.

Disposal of wastewater from shale and tight gas operations is a serious problem

- According to industry sources, after each fracking operation, around 30% of the fracking fluid flows back to the surface[12]. However, recent reports suggest as little as 6 to 8% may be recovered[13].

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[1] APPEA: The Natural Gas Revolution- Natural gas from shale and tight rocks.
[2] 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';
[3] UNEP Global Environmental Alert Service: *Gas Fracking: Can we safely squeeze the rocks?*
[4] European Parliament, Economic & Scientific Policy Dept, *Impacts of shale gas and shale oil extraction on the environment and on human health.*
[5] WA Govt: *Natural gas from shale & gas fact sheet: water use & management.*
[6] *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.*
[7] APPEA: The Natural Gas Revolution- Natural gas from shale and tight rocks.
[8] Hazen and Sawyer, December 22, 2009. Impact Assessment of Natural Gas Production in the New York City Water Supply Watershed.
[9] Ibid
[10] APPEA: The Natural Gas Revolution- Natural gas from shale and tight rocks.
[11] National Toxics Network: *Toxic Chemicals in the Exploration and Production of Gas from Unconventional Sources.*
[12] APPEA: The Natural Gas Revolution- Natural gas from shale and tight rocks.
[13] Hansen, Mulvaney & Betcher, *Water resources reporting and water footprint from Marcellus Shale development in West Virginia & Pennsylvania*

- 'Produced' water, underground water in or near the drilling area, can also come to the surface during gas production. For a typical shale gas well, daily produced water volumes range from 300 – 4,500 litres[14].
- 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[15].
- The large volumes of waste water produced from shale and tight 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'[16].

Shale and tight gas mining places water resources at risk

- Gas industry proponents assert that because shale and tight gas extraction involves deeper rock layers, they are somehow safer than gas extraction from shallow coal seams. This is deceptive. A recent European Commission Report[17] stated that there is an overall **high risk** of ground and surface water contamination resulting from gas operations involving fracking activities.
- US studies have implicated shale gas in the contamination of groundwater with heavy metals, salts and gas[18]. 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[19]. After 20 years this failure rate may increase to 50%, as wells corrode and cement casings degrade[20].
- Groundwater contamination can also occur if gas and toxic flowback fluids migrate from gas wells into aquifers through natural underground faults or fractures created during fracking operations.
- 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[21]. Other research has found increased methane concentrations in water bores closer to shale gas wells, creating an explosion hazard[22].
- Surface water pollution can occur when there are accidental spills of fluids or solids at the surface, when well blow outs occur, and through discharge of insufficiently treated waste water into waterways. Studies from Duke University in the US have found high levels of radioactivity in a creek used for disposal of wastewater [23].
- There is ever-increasing evidence from across the US of significant depletion and contamination of water resources and waste management issues from unconventional gas operations[24].

Shale and tight gas operations can have serious consequences for human and animal health

- Communities living near gasfields in the US have reported serious health effects following the commencement of shale and tight gas operations[25]. These conditions include serious respiratory ailments, nose throat and eye irritations and neurological illnesses[26].
- 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[27].

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[14] Bill Chameides, *"Natural Gas, Hydrofracking and Safety: The Three Faces of Fracking Water,"* National Geographic, September 20, 2011.
[15] Ibid
[16] National Toxics Network: *Toxic Chemicals in the Exploration and Production of Gas from Unconventional Sources.*
[17] Broomfield Mark, *Support to the identification of potential risks for the environment and human health arising from hydrocarbons operations involving hydraulic fracturing in Europe*. AEA Technology, 2012.
[18] Fracking: The evidence, https://docs.google.com/file/d/0B1cEvov1OlyHdzRBRjk4dElfbVE/edit?pli=1
[19] Ibid
[20] *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.*
[21] 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*
[22] Osborn et al 2013. *Methane contamination of drinking water accompanying gas-well drilling and hydraulic fracturing*. PNAS, May 17 2011.
[23] Warner et al, *Impacts of Shale Gas Wastewater Disposal on Water Quality in Western Pennsylvania*, Environ. Sci. Technol., **2013**, 47 (20), pp 11849–11857
[24] Western Organization of Resource Councils: *Watered Down: Oil & gas production & oversight in the wes; Fracking: the evidence, https://docs.google.com/file/d/0B1cEvov1OlyHdzRBRjk4dElfbVE/edit?pli=1;* Hansen, Mulvaney & Betcher, *Water resources reporting and water footprint from Marcellus Shale development in West Virginia & Pennsylvania.*
[25] Centre for Environmental Health: *Toxic and Dirty Secrets: The Truth about Fracking and Your Family's Health.*
[26] National Toxics Network: *Toxic Chemicals in the Exploration and Production of Gas from Unconventional Sources.*
[27] MICHELLE BAMBERGER, ROBERT E. OSWALD, *IMPACTS OF GAS DRILLING ON HUMAN AND ANIMAL HEALTH.*