

# IMPACT OF ENERGY GENERATION ON HEALTH: UNCONVENTIONAL GAS

DR HELEN REDMOND

Doctors for the Environment Australia

Extended Abstract, Presented 26 October 2013, Royal Society of Victoria

In this age of human-induced climate change, drilling for unconventional gas is expanding rapidly. In the United States hundreds of thousands of wells tap into shale gas, tight sands gas and coal seam gas (CSG). In Australia we have large CSG fields containing thousands of wells in Queensland, and several smaller fields in New South Wales and Victoria. The scale of proposed development of shale gas in South Australia, Western Australia and the Northern Territory will eclipse CSG in the eastern states. Yet unconventional gas extraction has the potential to undermine every single one of the environmental determinants of health: clean air, clean water, a safe food supply and a stable climate.<sup>1</sup>

To ensure health, water has to be sufficient in quality and quantity. The unconventional gas industry impacts both in a number of ways. Water quality can be threatened both by chemicals in drilling and fracking fluids, and by chemicals mobilised from deep underground in the process. The latter includes compounds naturally occurring in coal and shale formations: heavy metals, salt, volatile organic compounds (VOCs) (including benzene, toluene, ethylbenzene and xylene), and radioactive isotopes (including uranium).

Drilling and hydraulic fracturing fluids may contain carcinogens, mutagens, endocrine disruptors, irritants, sensitisers and substances that can cause harm to health if the dose and exposure are sufficient. In many states of Australia there is no mandatory disclosure of chemicals used in fracking fluids. Only four of the commonly used fracking chemicals in Australia have been assessed by the National Industrial Chemicals Notification and Assessment Scheme (NICNAS), our national industrial chemical regulator. None have been assessed specifically for use in fracking. Between 20% and 85% of the water and chemicals used for hydraulic fracturing stay underground and the process itself may create connectivity between the gas formation and nearby aquifers. In Pavillon, Wyoming, a US EPA three-year study found fracking chemicals have contaminated the town water supply, which is no longer safe to drink.<sup>2</sup>

In coal seams water must be removed first before the gas will flow. This may lower water levels in aquifers or change subterranean water flows. Landholders have observed water levels in beneficial bores dropping. Of

bigger impact on supply is hydraulic fracturing, which requires very large volumes of water. The CSG industry alone will extract 300 GL of groundwater per year (as a comparison, total extraction from the Great Artesian Basin for all purposes is 540 GL per year).<sup>3</sup>

Produced water includes what is produced from de-watering a coal seam, or return water after fracking, and contains chemicals and underground contaminants. It may be disposed of in evaporation ponds, or via approved discharge into waterways. It may be treated in reverse osmosis plants or used for irrigation. Accidental spills or illegal discharges are an inherent risk and have been documented in the industry.

Health impacts from unconventional gas extraction also arise from the pollution of air. The most common exposure pathway for humans living and working near gas operations is likely to be air, but research is in its infancy and is hampered by lack of environmental monitoring. During extraction unconventional gas may release fugitive emissions of methane and VOCs from produced water, drilling and fracking fluids. Diesel emissions from vehicle movements and equipment combine with VOCs to produce ground level ozone. Ozone is a pollutant known to induce lung inflammation and increase respiratory symptoms (particularly affecting people with asthma). Fine particulate air pollution may also be increased, leading to health impacts.<sup>4</sup> Rural areas in Wyoming and Utah with intense gas operations have measured ozone levels higher than the worst day of smog in Los Angeles.

A study of air quality in a Colorado gas field used US EPA guidelines to calculate health consequences for those living in proximity to gas wells. Results showed that residents living less than half a mile from wells are at greater risk for health effects than are residents living more than half a mile from wells. The non-cancer risk for residents less than half a mile from wells was driven primarily by exposure to airborne trimethylbenzenes, xylenes and aliphatic hydrocarbons. Cumulative cancer risk was also increased for those living nearby wells, mostly as a result of increased exposure to airborne benzene. Exposure to harmful air pollution was greatest at the time of well completion (fracking, flowback). Headaches, throat and eye irritation reported by residents during well completion

activities are consistent with known health effects of many of the hydrocarbons evaluated in this analysis.<sup>5</sup>

The unconventional gas industry affects health by threatening food safety and security. There is a very large and distributed surface impact with 1 ha well pads every 750 m, connected by 6 m wide roads and surface water and gas pipelines. Land area for gas processing, holding ponds and wastewater disposal contributes to competition for land use, and a loss of viable agricultural activity and reduced useable land area for cultivation. Chemical contaminants may end up in water, soil, crops and livestock, and ultimately in the foods we eat. Spill incidents can have dramatic effects on animal health.<sup>6</sup>

Methane is a potent greenhouse gas. It has a global warming potential 34 times that of CO<sub>2</sub> over a 100-year period and 72 times that of CO<sub>2</sub> over a 20-year period. Several full lifecycle analyses show that only 2–4% of gas needs to be lost as fugitive emissions to negate the greenhouse gas emission advantage that unconventional gas has over coal. Actual measurements are scarce and contested but range between 0.1% and 9% of gas produced.<sup>7</sup> Unconventional gas is a fossil fuel, and like all other fossil fuels we must leave it in the ground and switch rapidly to renewable energy if we are going to have an even chance of holding climate change to less than 2°C of warming.<sup>8</sup>

The hidden costs of damage to the environment, climate and ultimately human health have not been considered in the rush to exploit this new fossil fuel resource. Health risks from unconventional gas extraction are numerous, inadequately assessed and likely to be causing impacts on human health for decades to come.

## References

- 1 Submission on the Review of Coal Seam Gas Activities in NSW by the NSW Chief Scientist and Engineer, 8th May 2013. [http://dea.org.au/images/uploads/submissions/Review\\_of\\_CSG\\_in\\_NSW\\_-\\_Chief\\_Scientist\\_Submission\\_05-13.pdf](http://dea.org.au/images/uploads/submissions/Review_of_CSG_in_NSW_-_Chief_Scientist_Submission_05-13.pdf)
- 2 EPA releases draft findings of Pavillon, Wyoming ground water investigation, 12th August 2011 <http://yosemite.epa.gov/opa/admpress.nsf/20ed1dfa1751192c8525735900400c30/ef35bd26a80d6ce3852579600065c94e!OpenDocument>
- 3 Coal Seam Gas By the Numbers <http://www.abc.net.au/news/specials/coal-seam-gas-by-the-numbers/waste/>
- 4 Peng RD et al. Emergency admissions for cardiovascular and respiratory diseases and the chemical composition of fine particle air pollution. *Environ Health Perspect* 2009 117:957-63
- 5 McKenzie LM et al. Human health risk assessment of air emissions from development of unconventional natural gas resources. *Sci Total Environ* 2012;424 : 79-87 <http://www.ncbi.nlm.nih.gov/pubmed/22444058>
- 6 Bamberger M, Oswald RE. Impacts of gas drilling on human and animal health. *New Solutions* 2012; 22: 51-57
- 7 Coram A, Moss J, Blashki G. Harms unknown: health uncertainties cast doubt on role of unconventional gas in Australia's energy future. *MJA* 2014; 200 (4):210-213. <https://www.mja.com.au/journal/2014/200/4/harms-unknown-health-uncertainties-cast-doubt-role-unconventional-gas-australias>
- 8 The Climate Commission: *The Critical Decade 2013 – Climate Change Science, Risks and Responses* <http://climatecommission.gov.au/report/the-critical-decade-2013/>