AUSTRALIAN NURSING & MIDWIFERY FEDERATION NSW BRANCH

NEW SOUTH WALES NURSES AND MIDWIVES' ASSOCIATION
AUSTRALIAN NURSING AND MIDWIFERY FEDERATION NEW SOUTH WALES BRANCH

NSW NURSES & MIDWIVES' ASSOCIATION

IN REPLY PLEASE QUOTE:

Ref: BH: JRO

27 April 2017

The Honourable Anthony Roberts

The Minister for Planning, Housing,
and Special Minister of State in New South Wales.

office@roberts.minister.nsw.gov.au

Dear Minister

Re: Submission on Banning CSG in NSW and Opposition to the New Santos Proposal - The Narrabri Coal Seam Gas Project.

I am forwarding a submission in regard to Banning CSG in NSW and Opposition to the New Santos Proposal - The Narrabri Coal Seam Gas Project.

As this is an issue relating to Resources and Energy, the members of the New South Wales Nurses & Midwives' Association (NSWNMA) have instructed that this submission be forwarded to your office.

The Committee of Delegates has called on the Association to support efforts of nurses, midwives and community members of NSW in their stand against Coal Seam Gas to ensure the safety of their environment.

The NSWNMA thanks you for the opportunity to make this submission on this important issue. Should you require any further information on this matter, please contact Dr Janet Roden, Professional Officer on 0447472154 or jroden@nswnma.asn.au

Yours sincerely

Brett Holmes

BRETT HOLMES

General Secretary
NSW Nurses and Midwives' Association

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Australian Nursing and Midwifery Federation NSW Branch ABN 85 726 054 782 I NSW Nurses and Midwives' Association ABN 63 398 164 405

IN REPLY PLEASE QUOTE:

Submission by the New South Wales Nurses & Midwives' Association and the Australian Nursing & Midwifery Federation New South Wales (ANMF NSW) Branch.

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The New South Wales Nurses and Midwives' Association (NSWNMA) is the registered union for all nurses and midwives in New South Wales. The membership of the NSWNMA comprises all those who perform nursing and midwifery work. This includes assistants in nursing (who are unregulated), enrolled nurses and registered nurses and midwives at all levels, including management and education.

The NSWNMA has approximately 64,000 members and is affiliated to Unions NSW and the Australian Council of Trade Unions (ACTU). Eligible members of the NSWNMA are also deemed to be members of the New South Wales Branch of the Australian Nursing and Midwifery Federation.

Our role is to protect and advance the interests of nurses and midwives and the nursing and midwifery professions. We are also committed to improving standards of patient care and the quality of services in health and aged care services. Our concern about the health of our nurses, midwives and the community has prompted our desire to make this submission about banning Coal Seam Gas (CSG) in NSW, including the banning of the new Santos proposal – the Narrabri Coal Seam Gas project.

We welcome the opportunity to make submission to this important Environmental Issue and the opportunity for wider discussion that this provides.

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Table of contents

Introduction

The Association is committed in its need to promote a complete ban on unconventional gas or Coal Seam Gas (CSG) across New South Wales. NSWNMA is opposed to the Australian government's continuing support for the fossil fuel industry (Hudson, October 27, 2016).[1] As members of the NSW Branch of the Australian Nursing and Midwifery Federation we are supportive of the Trade Unions for Energy Democracy (TUED).[2]

On the basis of this position, The Association is also not in favour of the proposed up-coming Santos Narrabri Coal Seam Gas (CSG) Project. Research provides evidence of the health problems associated with unconventional gas and human health[3],[4]

The Association has a close relationship with the Climate and Health Alliance (CAHA) who are supportive of healthy communities and have developed a Framework for a National Strategy on Climate, Health and Well-being for Australia.[5]

For this reason the Association's support for opposing Coal Seam Gas mining across NSW stands as an important imperative, and in line with this position we are opposed to the Santos Narrabri Coal Seam Gas Project going ahead. This submission will focus on the health and environmental issues associated with unconventional gas or Coal Seam Gas.

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[1] Hudson, M. (27 October 2016). Another prime minister, another endorsement for coal – but why? *The Conversation*, at http://theconversation.com/another-prime-minister-another-endorsement-for-coal-but-why-67649, accessed 27 October 2016

[2] *Trade Unions for Energy Democracy* at http://unionsforenergydemocracy.org/

[3] Dr Philippe Grandjean MD & PhilipJ Landrigan MD, Neurobehavioural effects of development toxicity, *The Lancet Neurology*, Vol 13, Issue 3, pages 330-338, March 2014.Accessed on 29th March, 2017 from/http://www.thelancet.com/journals/laneur/article/P11S1474-4422(13)70278-3/abstract

[4] Zeliger HI Unexplained cancer clusters: common threads. *Arch Environ Health.* 2004 Apr, 59(4);172-6. Accessed on 29th March, 2017, from: http://www/ncbi.nim.nih.gov/pubmed/1618998

[5] *Our Climate, Our Health. Draft Framework for a National Strategy on Climate, Health and Well-being for Australia*, 9th March, 2017, pp. 1-30. The Climate and Health Alliance.

Executive Summary

As nurses and midwives we believe that an ecologically sustainable environment promotes health and wellbeing. The NSWNMA is calling for a ban on Coal Seam Gas (CSG) in NSW, now, and in the future. It is argued that primarily as nurses and midwives we are concerned about the health of communities involved in CSG.

Damaging or contaminating aquifers in NSW through the production of reduced or contaminated water is an act of negligence from which there is no return. If aquifers are contaminated with toxic substances as has occurred in the case of Santos in 2014, water source testing must be carried out immediately, which did not occur with this incident. As there is evidence that toxic chemicals like radium and radon produce cancer in humans, years later after their exposure, human health can be severely compromised. In addition concern arises out of the fact that all gas wells leak eventually and become more toxic the older they get.

CSG mining companies do not have a great record in regard to appropriate and positive action, as has been identified through evidence in this submission. There is only one Great Artesian Basin and once it is destroyed Australia is in serious trouble in regard to its water supply. The most promising outcome would be a lasting ban on CSG activities in NSW which would ensure that no damage is done to the water resources we have in NSW in the future. This would remove the need for the NSW Government for continuing their vigilance on CSG companies and their operations.

An even greater source of worry which cements the need for banning CSG in NSW is the resulting air pollution caused by CSG mining activities. At present there is no policy in place to ensure an accurate way of assessing and monitoring air pollution in NSW. Particulate matter that arises from coal seam gas activities is dangerous and research has found that such illnesses as heart attacks, strokes, diabetes, asthma, hypertension and renal disease are prevalent. Moreover respiratory, neurological diseases and cancers are more likely for residents living less than half a mile from CSG wells. Research regarding the exposure of children and pregnant and new mothers to air pollution has also been noted. There is no way that communities and the workers will be free from these illnesses with the existing CSG well production and the addition of another 850 new CSG wells now planned by Santos.

Definition of Terms

BTEX..... Benzene, Toluene, Ethylbenzene, and Xylenes

CSG..... an invasive form of unconventional gas mining. It usually involves tens of thousands of gas wells, with roads, pipelines, compressor stations, wastewater dams, and other infrastructure

EIS.....Environmental Impact Statement

Flaring.....the burning off of natural gas from a new well

Fracking.... Reaching and extracting gas in fossil fuel deposits involves drilling and sometimes hydraulic fracturing (fracking) of underground structures.

GAB.....The Great Artesian Basin

NORMs.....Naturally occurring radioactive materials

Particulate Matter...Material suspended in the air in the form of minute solid particles or liquid droplets, especially when considered as an atmospheric pollutant

PAH.....polycyclic aromatic hydrocarbons (PAH)

UG.....Underground

USEPA.....United States Environmental Protection Agency

VOCs.....Volatile organic compounds

Brief History

Coal Seam Gas (CSG) in New South Wales began 30 years ago. During this time quite a few mines were capped because they were no longer viable. According to the NSW Department of Trade and Investment, in September 2011 there was a total of 493 CSG exploration and production wells that had been drilled in NSW.[6] Currently there are active CSG wells in Camden, Molong, Wollongong and the Pilliga areas in NSW [7],[8]. The largest current site is Camden which has 117 wells, some which range from 13 to 30 years old. It is interesting to note that the company AGL have used the damaging process of fracking to frack 117 wells at the Camden Gas project but that this company have not conducted any surrounding ground water monitoring – there may be contamination of aquifers but one will ever know unless studies are conducted.[9]

In the case of the Gloucester CSG area, it has 110 gas mines. In 2012 an environment group had challenged approving these gas mines and the matter went before the Land and Environment Court. This resulted in a landmark court case with the AGL gas well mines' plans having collapsed.[10]

The reason that all CSG and coal mines must be abolished is that even though the Land and Environment Court have upheld their decision there is talk now of the Rocky Hill Coal Mine threatening Gloucester Valley. Moreover the existing Statford plant which is not active now (unlike the Duralie mine) could start up and if approved it could extend coal mining in the valley for decades. Due to the fickle nature of company decisions and the government support for this, there are no guarantees that CSG mining, particularly dangerous to human health, may not start up again as well. The health concerns of the local community are that schools and hundreds of homes

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[6] Factbox: CSG in Australia. *SBS News.* Accessed 11th April, 2017 from: http://www.sbs.com.au/news/article/2013/03/12factbox-csg-australia

[7] The coal seam gas rush, Udated 28 Jun 2012. *ABC Radio*, Accessed on 29th March,2107 from: http://www.abc.net.au/news/specials/coal-seam-gas-by-the-numbers/

[8] *Narrabri Gas Project, New South Wales. Government Department of Planning,* accessed on 24th March, 2017 from http://www.majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=6456

[9] Feliu, L. Protests erupt as CSG fracking approved. (August 7, 2014) *Echo NETDAILY.*

[10] Court to hand down decision on proposed Gloucester gas wells. (Posted 27 August, 2012). *ABC NEWS*. Accessed on 4th April, 2017 from: http://www.abc.net.au/news/2012-08-27/court-to-hand-down-decision-on-proposed-gloucester-gas-wells/4225138

are within 5 km of the health danger zone of the project's first stage. Future expansion could see the homes 1 km away from the expansion of coal activities.[11]

The Association is arguing that productive CSG mines in NSW should be discontinued firstly on the basis that they are perpetuating the problem of climate change. CSG fields contribute to climate change through the leakage of methane during the production, transport, processing and the use of coal seam gas. Climate change is actually increased because it is fuelled by coal seam gas.

Of course the fuelling of climate change by these CSG wells leads to another important reason for banning CSG mining – that of more air pollution which is potentially damaging to human health. Many of these CSG mines are only 60 kilometres south from the biggest city in Australia- Sydney, in NSW. There is also no non-mining buffer zone around this urban area.

So it follows that a third vital reason for banning CSG mining is that there is always a danger that it may interfere with aquifers or contaminate aquifers which are sources of drinking water for the surrounding population. In the case of the large population of Sydney this is a big concern. Another concern is that according to the National Water Commission if large amounts of treated waste water are released this could alter the natural flow patterns and impact on water quality, river and wetland health. Of further concern is that according to the report prepared by the Institute for Sustainable Futures at UTS for the City of Sydney Council the water supply can be affected if the holes drilled into the ground are not properly sealed with cement. [12] This could be a problem as some old mines have been capped but how well this process has been carried out is not always clear.

Another useful piece of information relates to the existing older wells that should be capped because they get more toxic. As the salinity of older wells builds up higher levels of radioactivity that are found in coal seams builds up. This is a good argument for permanent capping of these wells and the end of CSG mining.[13]

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[11] Lock the Gate. Accessed 4th April, 2017 form: http://grouindswellgloucester.com

[12] Factbox: CSG in Australia. SBS News. Accessed on 11th April, 2017 from : http://www.sbs.com.au/news/article/2013/03/12/factbox-csg-australia

[13] http://www.world-nuclear.org/info/Safety-and-Security/Radiation-and-Health/Naturally-Occurring-Radioactive-Materials-NORM/#.UTIc2qXfCcM

The New South Wales Government's Promotion of CSG

Now with the pressure to produce more gas for domestic purposes [14] the NSW Government is supporting the development of new CSG projects. Santos have just submitted an Environmental Impact Statement (EIS) to drill 850 CSG wells in the Narrabri region. The NSW Government have produced mining documents that demonstrate that technology is now superior, and that many mining assessments are carried out to ensure that CSG mining is a safe pursuit.[15] However there is continuing evidence that unconventional gas is problematic. CSG mining companies like Origin, AGL, Woodside, and Metgasco have all had contamination issues or other problems like well gas leaks. Santos certainly had a large number of CSG problems in the Pilliga in 2012, with chemical contamination and a large pollution spill of 10,000 litres in the Pilliga State Forest which they initially tried to hide. [16]

The Protection of the Environmental Operations (General) Regulation 2009 was amended, empowering the Environmental Protection's Authority (EPA) to be the lead regulator and introducing a risk-based approach to environmental licensing.[17] However in 2014 the Santos CSG in the Pilliga Forest produced contaminated aquifers with very harmful levels of radium and radon but they did not test this site at all. A lack of trust is warranted in this case, although the government report refers to trying to change the 'lack of trust' that the community holds in regard to CSG activities (see page 8).

It is difficult to regard CSG companies (and their regulator) as trustworthy in their ventures. Further material in the Chief Scientist's Report suggests that risks can be managed, particularly that of sensitive areas near drinking water catchments and that risk management must be of a high level order. Yet there is also acknowledgement on page 10 in the Report that there is a need to better understand the nature of risk of pollution from CSG and its related operations; and that new knowledge and

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[14] SMH Digital Edition, *The Conversation,* March 15, 2017.

[15] Coal Seam Gas in NSW. *NSW Government. Planning & Environment Resources & Energy.* Accessed on April 11,2017 from: http://www.resourcesandenergy.nsw.gov.au/landholders-and-community/coal-seam-gas

[16] Klan, A. (January, 2012). Coal-seam gas pollution spill went unreported. *The Australian.* http://www.theaustralian.com.au/national-affairs/coal-seam-gas-pollution-spill-wentunreported/story-fn59niix-1226244002610

[17] Chief Scientist & Engineer. *Final Report of the Independent Review of Coal Seam Gas Activities in NSW, NSW Government,* September 2014.

technologies are becoming available but need to be harnessed so that CSG extraction becomes safer and more productive in the future. These findings do not fill one with confidence, especially the last section of page 11, which states that there are no guarantees as all industries have risks.

CSG Well Accidents

This submission will address the CSG well accidents that have occurred in regard to air pollution and aquifer damage in NSW, and Queensland primarily, whilst also referring to other countries like the US, Canada and UK, and cases and accidents that have occurred and are similar and supportive of those more local accidents.[18]

Contamination and accidents at CSG sites mostly occurred from 2010 through to 2012, and were as high as 40 incidents, according to the Aidan Ricketts site.[19] As Queensland has the majority of CSG sites most incidents occurred there, but other sites like Casino, Northern Rivers, Camden and the Pilliga (northern NSW) in NSW were also involved. All different kinds of issues have been reported such as spillages into rivers, uncontrolled discharges of CSG water, gas fire burnings, gas causing bubbling in rivers, arsenic and lead found in contaminated water, CSG gas leakages, well blow outs, fracking causing interconnectivity between aquifers and toxic chemical finds, and serious injuries.

The United Nations Environment Programme and EU Reports make the point that even if unconventional gas is extracted properly, that in practice there are many accidents from leaky or malfunctioning equipment.[20] As in Australia in the case of the Tara, Queensland field developed by British Gas with 26 out of 58 wells leaking, in the USA there were 200,000 wells not properly plugged and 40-50,000 that were likely to be pollution problems.[21]

Concerns comes out of the statement that all gas wells leak eventually and that this problem won't go away and will still be there after companies no longer exist.[22]

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[18] Davey, B. *The Unacceptable Impacts of Coal Seam Gas and Shale Gas Extraction*. Accessed on April11, 2017. From: http://www.resilience.org/stories/2013-12-10/the-unacceptable-impac

[19] Rickets, A. (October 31, 2012) Contaminated sites and accidents related specifically to CSG/LNG in Australia. *ACTIVISIT*. Accessed on 4th April, 2017 from: http://aidanricketts.com/contaminated-sites-and-accidents-related-specifically-to-csglng

[20] *United Nations Environment Programme.* Global Environment Alert Service Nov 2012. .Accessed April18, 2017 from: http//www. http://wedocs.unep.org/handle/20.500.11822/8381

[21] Suro, R. Abandoned Oil and Gas Wells Become Pollution Portals.(May3, 1992). *New York Times*. Accessed on 18th April, 2017 from: http://www.nytimes.com/1992/05/03/us/abandoned-oil-and-gas-wells-become-pollution-portals.html?src=pmLink

[22] Davey, B. *The Unacceptable Impacts of Coal Seam Gas and Shale Gas Extraction.* Accessed on April11, 2017. From: http://www.resilience.org/stories/2013-12-10/the-unacceptable-impac

Risk to Human Health

Contaminated Water Sources

New South Wales Nurses & Midwives' Association is opposed to any current or potential CSG project in NSW. Unfortunately coal seam gas uses enormous amounts of water – one of Australia's scarcest resources. Water is pumped from the ground as part of the coal seam gas extraction process and this process produces huge amounts of very salty water, as well as many naturally present chemicals, and may include heavy metals and radionuclides as by-products.

While the treatment of coal seam gas water is designed to remove unwanted contaminants some chemicals including boron, silver, chlorine, copper, cadmium cyanide and zinc remain in treated CSG water. It is noted that many of these concentrated chemicals (of water released) could be toxic to aquatic organisms.[23]

In 2014, as briefly mentioned before, the Santos coal seam gas project in the NSW Pilliga Forest was found to have contaminated aquifers. Concern was raised as there was Uranium at 335 micrograms per litre which is **twenty times** the Australian Drinking Water guideline of 17ug per litre.[24] Detection of Uranium at 335 micrograms per litre was well above the usual Uranium form of 238 micrograms per litre and there should have been immediate testing for harmful radionuclides like Radium 226 and Radon 222, in the ground water. This event should have been reported, testing for radioactivity should have occurred and actions taken to clean up the contaminated aquifers.

Both radium and radon are known carcinogens, and care should be taken when they are ingested or inhaled. [25],[26] Exposure to radium can result in increased incidence of

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[23] The coal seam gas rush, Updated 28 Jun 2012. *ABC Radio*, Accessed on 29th March,2107 from: http://www.bing.com/search?q=The+coal+seam+gas+rush,+Udated+28+Jun+2012.+ABC+Radio,&src=IE-TopResult&FORM=IETR02&conversationid=

[24] Santos coal seam gas project contaminates aquifer. *SMH, 2014*. Accessed on 29th March 2017 from: http://www.smh.com.au/environment/santos-coal-seam-gas-project-contaminates-aquifer-20140307-34csb.html

[25] Toxic Substances Portal – Radium. *Agency for Toxic Substances & Disease Registry*. July, 1999. Accessed on 29th March, 2017 from: http://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=790&tid=154

[26] NCR. Health effects of radon progeny on non-lung-cancer outcomes. In :*Health Effects of Exposure to Radon, BEIR VI. Washington, DC: Committee on Health Risks of Exposure to Radon (BEIR VI), National Research Council*, National Academies Press (1999). Accessed on 29th March, 2017 from: http://www.nap.edu/openbook.php/record_id=5499&page=118

bone, liver and breast cancer whilst drinking radium in drinking water can cause lymphoma, bone cancer and leukaemias.[27] Radium emits gamma rays which raise cancer risk throughout the body from exposures that are external. The inhalation of radon can cause lung cancer and some evidence suggests it may cause leukaemias.

The Queensland Australian Medical Association confirmed that several of its doctors had raised concerns that residents living near CSG mining operations could be showing symptoms of gas exposure.[28] People living in the Tara region, Queensland are in close proximity to CSG mining sites and have reported symptoms of headaches, nausea, dizziness, nose bleeds, skin rashes, sore, and itchy eyes, pins and needles, nasal congestion, metallic taste, depression, diarrhoea, respiratory symptoms, anxiety and stress and blackouts.[29]

There is limited knowledge about the possible adverse health outcomes resulting from the effects of CSG (and all its processes) on humans but peer reviewed scientific studies do show that people living near unconventional gas are at greater risk of air pollution. [30] Vaneckova and Bambrick [31] note that the health risks in relation to CSG may occur at different stages of production, and that the long term effects of CSG exposure may not appear for ten years or more. Fracking fluids remain a potentially harmful threat to human health. Although fracking is not used as frequently now it can be a significant health threat especially if it contaminates ground water aquifers, rivers, or other waterways. Contaminants that come from coal seams during fracking add to the mix of chemicals which means that they could affect both ground and surface water quality and could end up affecting people's health.

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[27] EPA. Radionuclides: Radium (web site). Washington, DC: Office of Radiation and Indoor Air, *U.S. Environmental Protection Agency* (updated 6 March 2012). Accessed on 29th March, 2017 from: http://www.epa.gov/radiation/radionuclides/radium.html#affecthealth

[28]Turnbull, S. & Shoebridge, J. (July, 2012). Coal seam gas blamed for health problems. *ABC North Coast NSW*. Accessed on 18th April, 2017 from: http://www.abc.net.au/local/stories/2012/07/06/3540381.htm

[29] *State of Queensland, (Queensland Health)* (2013) Coal seam gas in the Tara Region; summary risk assessment of health complaints and environmental monitoring data. Accessed on 5thApril, 2017, from: http://www.health.qld.gov.au/publications/csg/

[30] *Health Effects Research. Californian Environmental Protection Agency.* Air Resources Board. Accessed on 18th April, 2017 from: https://www.arb.ca.gov/research/health/healthres.htm

[31] Vaneckova, P & Bambrick, H. (August 2014). Approaches to baseline studies of human health in relation to industries with potential environmental impact. Contribution to the independent review of coal seam gas activities in NSW. *Centre for Health Research,* University of Western Sydney.

Although BTEX (benzene, toluene, ethylbenzene, and xylenes) has been banned from this process it can still occur naturally. Also storage and treatment of the extracted water may similarly be a hazard to human health. Water produced through CSG mining processes is highly saline and brackish and also contains heavy metals and drilling chemicals that could affect the immune and cardiovascular systems, as well as the nervous and endocrine systems. Moreover International studies show that kidney disease, cancer and other mutating illnesses are also reported.[32] This could certainly be a public health risk for the local community, in the Tara Region, Queensland, and the Pilliga area NSW where many vulnerable Indigenous Aboriginals live in the highest number of polluting sites. Both of these regions have their water source or underground aquifers coming from the Great Artesian Basin (GAB). Great Artesian Basin (GAB) water is used for a number of cultural and social purposes. For traditional owners, GAB water is connected to cultural and spiritual values, but also sustains life. GAB springs are sites of storytelling and ceremonial importance.[33] GAB water is vital to many rural communities, who rely on it for town water and their local economy. GAB water has social significance to many regional towns. Coal seam gas could damage water resources that come from the Great Artesian Basin. This does not equate to environmental justice for these people in farming communities and Indigenous Australians.[34] The threat of contaminated water to food production and food security, as well as human beings also needs to be acknowledged.

There is another big threat to public health from CSG mining and that is air pollution. It has already been noted that the burning of fossil fuels like coal and gas are contributors to Climate Change which is associated with serious health issues.[35],[36] Just like the burning of coal, promoting CSG fuels dangerous climate change through the production of methane gas. Furthermore the bushfire risk will increase if CSG

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[32] Colburn, T., Kwiatowski, C., Schultz, K., Bachran, M. (2011). Natural Gas Operations from a Public Health Perspective. Human and Ecological Risk Assessment: *An International Journal, 17:* 1039-1056.

[33] Great Artesian Basin social and cultural water uses. Department of Natural Resources and Mines. Accessed on 30thMArch2017, from: https://www.dnrm.qld.gov.au/__data/assets/pdf_file/0010/1039438/gab-factsheet-social-cultural-water-issues.pdf)

[34] *NTN National Toxics Network.* Accessed on 28th March, 2017, from: http://www.ntn.org.au

[35] The Lancet Commissions, Nov 2015; Health and climate change: policy responses to protect public health. *The Lancet*, vol. 386, no. 10006, p. 1861-1914. DOI: http://dx.doi.org/10.1016/S0140-6736(15)60854-6

[36] *Our Uncashed Dividend.* The health benefits of climate action. August, 2012.

mining goes ahead with its 850 CSG wells in the Pilliga region. This region already has major bushfires and CSG wells cause methane flare stacks which rise to fifty metres and can occur day and night. Ways of containing fires are difficult and ignition will regularly occur especially if this CSG project comes to fruition.[37]

[37] *Daisy* – Nature Conservation Council of NSW.

Risk to Human Health

Air Pollution

The process of coal seam gas mining means that the environment is toxic with huge earth moving, diesel vehicles, clouds of black, foul smelling smoke and vast destruction of trees, plants and wildlife that upset farmers and their families.

To further inflame the situation flaring, which is the burning of natural gas from a new well, occurs often in gas fields and also causes the release of pollutants. The USEPA has banned gas flaring after January 2015 as they are concerned about air pollution.[38] Particulate matter (PM) which is a product of CSG mining, has significant health impacts including heart attacks, strokes, diabetes, asthma, hypertension, and renal disease. Moreover human health risk assessment of air emissions around US UG activities found that residents who were closest to well pads ie. less than half a mile from these wells, had a higher risk for cancer and a higher risk of both respiratory and neurological conditions caused by their exposure to air pollution.[39] This study showed that emissions measured by the fence line at well completion were statistically higher than those emissions at the fixed location station. Even sampling around UG activities in Australia have shown that the cancer risk hydrocarbons of BTEX and benzene were present.

In CSG mining areas children are particularly at risk as their detoxification systems are immature and their blood-brain barriers are still developing.[40] They have a greater risk than adults because of their high respiration and metabolic rate, eating and drinking more per body weight, living closer to the ground and often crawling and digging, and being unaware of chemical exposure risks.[41] Not only the exposure of

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[38] Controlling Air Pollution from the Oil and Natural Gas Industry. *United States Environmental Protection Agency*. Accessed on April, 18th 2017, from: https://www.epa.gov/controlling-air-pollution-oil-and-natural-gas-industry

[39] Lisa M. McKenzie, Roxana Z. Witter, Lee S.Newman and John L. Adgate, Human health risk assessment of air emissions from development of unconventional natural gas resources. *Science of the Total Environment* March 21, 2012, cited in *NTN National Toxics Network.* Accessed on 28th March, 2017, from: http://www.ntn.org.au

[40] Landrigan, PJ et at. 1998. Children's health and the environment: A new agenda for prevention research. *Environmental Health Perspectives 106*, Supplement 3:787-794, cited in *NTN National Toxics Network.* Accessed on 28th March, 2017, from: http://www.ntn.org.au

[41] Loyd-Smith, Mariann; Sheffield-Brotherton, Bro, 'Children's Environmental Health: Intergenerational Equity in Action – A Civil Perspective,' *Annals of the New York Academy of Sciences*, Vol. 1140:1, pp.

children, but that of mothers who are pregnant whose foetuses receive toxins can be of concern. This toxin transfer also occurs with babies drinking breast milk. If exposure occurs at critical developmental times for babies and children then the child may experience illnesses in later life. For example, early exposure to carcinogens can increase the risk of cancer in later life, whereas if there is exposure to dioxin in utero then neurological functioning can be damaged and learning difficulties may follow.[42],[43]

However the health risks do not end there. Early exposure to endocrine disrupting chemicals like hydrocarbons can affect a person's immune system or their ability to reproduce. In the Tara Queensland CSG mining site polycyclic aromatic hydrocarbons (PAH) were detected in residents' urine and would also be found in air circulating around houses. These PAHs are known to affect the endocrine system, even at extremely low levels. Children and unborn babies are the most vulnerable to this health risk. Babies who had elevated PAHs detected in their umbilical cord blood were more likely to have a high score on the anxiety/depression scale than those who had lower PAH cord blood levels.[44] In utero and infancy these pollutants can cause permanent brain damage while mixtures of chemicals have been implicated in cancer clusters.[45],[46]

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