CLIMATE AND HEALTH ALLIANCE

Submission to the NSW Chief Scientist and Engineer

Review of coal seam gas activities in NSW

April 2013

"Public health experience indicates that in a range of environmental contamination issues prevention is the mainstay to protection. Think of lead or asbestos for example; adequate assessment and regulation are key measures." (Shearman 2012)

"Without rigorous scientific studies, the gas drilling boom sweeping the world will remain an uncontrolled health experiment on an enormous scale." (Bamberger and Oswald 2012)

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About the Climate and Health Alliance

The Climate and Health Alliance (CAHA) is a not-for-profit organisation that is a national alliance of organisations and people in the health sector working together to raise awareness about the links between ecology and health including the health risks of climate change and the health benefits of emissions reductions.

CAHA's members recognise that health care stakeholders have a particular responsibility to the community in advocating for public policy that will promote and protect human health.

The membership of the Climate and Health Alliance includes a broad cross section of the health sector with 27 organisational members, representing health care professionals from a range of disciplines, health care service providers, institutions, academics, researchers, and health consumers.

For more information about the membership and governance of the Climate and Health Alliance, please see Appendix A. For further information see www.caha.org.au

Issues addressed in this submission

This submission addresses the following issues raised in the terms of reference for the review of coal seam gas (CSG) related activities in NSW:

> (a) human health risks arising from coal seam gas exploration, assessment and production
> (b) health implications of the interface between unconventional gas projects and urban areas, particularly CSG activity in close proximity to residential properties
> (c) health implications related to inspection and monitoring of drilling activities including water extraction, hydraulic fracturing and aquifer protection techniques

Executive Summary

Current assessment, regulation and monitoring of CSG impacts on the environment, public health and vulnerable communities is insufficient to provide confidence of adequate safeguards of humans and the environment (Carey, 2012)

Coal seam gas (CSG) 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 adverse economic, social and environmental impacts affecting the health and wellbeing of urban and rural communities, and at a population level, by increasing greenhouse gas emissions and exacerbating the health impacts of climate change.

However the nature and scale of the risks posed to human health are difficult to establish due to inadequate disclosure. At present, there is no requirement for coal seam gas companies to declare the chemicals used in, or produced during CSG mining. This makes monitoring for

health effects very difficult. Many of the chemicals that are known to be used in the coal seam gas mining process known as ‘fracking’ in Australia have not been tested for their safety with regard to human health and mining companies have been reluctant to disclose the chemicals used.

There are serious concerns for health with regard to the chemicals that are known to be used, with potential risks of neurological, respiratory, reproductive, cardiovascular, endocrine and kidney disorders (Lloyd-Smith and Senjen 2011).

The seriousness of these risks suggests there is a need for open disclosure of chemical along with a dramatic improvement of monitoring of air and water quality around mining sites. This should include baseline environmental monitoring prior to commencement of activity, followed by regular and effective monitoring. It is vital that monitoring sites are adjacent to mining activity sites.

In addition to potential exposure to toxic chemicals and gases in exploration and extraction of coal seam gas, risks to health include impacts on mental health in farming communities arising from consequences of mining activity on farming activity (grazing and crops) and adverse impacts on land value associated with mining. These risks to health should also be evaluated in the approval of mining licences.

Fracking operations raise serious concerns about water quality and harm to underground aquifers from coal seam gas mining, as well as serious climate implications from large qualities of fugitive methane emissions during coal seam gas extraction. Methane is one of the most powerful of the short term greenhouse gases (Kember, 2012) and recent research suggest CSG operations may lead to the release of large volumes of methane, contributing to further global warming and climate change (Santos and Maher 2012).

The international medical journal *The Lancet* in 2009 stated: “Climate change is the biggest global health threat of the 21st century” (Costello et al, 2009). Climate change is likely to bring with it new and unexpected health impacts as well as acting as a threat multiplier to all existing health risks.

No further coal seam gas exploration or mining should occur until there has been a thorough assessment of risks to health, water resources, farmland and food security, local communities, natural biodiversity, and cultural heritage and an evaluation of the implications of greenhouse emissions from coal seam gas production have been undertaken.

Human health risks arising from coal seam gas exploration and production

Coal seam gas trapped in coal seams is the predominant form of unconventional gas in NSW and Queensland. Shale gas is trapped in shale formations; this is the predominant form in the US, and in Australia it has been located in the Cooper Basin in Central Australia.

Proponents of coal seam gas mining often seek to draw distinctions from shale gas mining in order to play down the adverse impacts of shale mining reported in the US. However public health concerns exist with both forms of mining (Shearman, 2012).

Early Australian research into fugitive emissions from coal seam gas drilling in proximity to residences in Queensland indicate that “detection of dangerous air toxics around residents’ homes combined with the ongoing reporting of adverse health symptoms should be treated seriously and a scientifically valid investigation should be undertaken which ensures independence and is based on a rigorous monitoring program which is broad-spectrum, high-periodicity and long-term” (National Toxics Network, 2013)

The risks extend beyond health to climate security, as gas does not offer a panacea for Australia’s emissions woes. Market pressure for a shift to conventional fossil gas as an energy source to replace coal and claims that gas is “clean energy” should be viewed with caution. There is emerging evidence that the emissions from gas are much higher than reported levels, with a recent paper indicating gas accounts for 40% of anthropogenic greenhouse gas emissions in the US. New methods for evaluating methane emissions from gas have produced a two fold increase in reported emissions from the gas industry in the US. In addition, gas from shale deposits is estimated to have a higher greenhouse signature than coal. (Carey, 2012; Howarth et al 2011, 2012). This suggests wide scale shift to gas may exacerbate the onset of dangerous climate change and its accompanying risks to human health.

What could go wrong for public health?

Increasing scientific evidence from the US and Australia indicates high levels of health and wellbeing risks from unconventional gas activity in proximity to residential properties in urban, rural and more remote areas (Colborn et al., 2012, Santos & Maher, 2012, Smith et al, 2013).

In the Australian context, a research review by Dr Marion Carey, public health physician and VicHealth Senior Research Fellow at Monash Sustainability Institute, finds that coal seam gas (CSG) exploration and extraction carries potentially significant human health and environmental impacts, as well as risks to animal health, however many of these risks are currently unquantified (Carey, 2012).

A study of risks for the environment and human health arising from hydraulic fracturing in Europe assessed the main risks at each stage of a project (well-pad) development, and also covered the cumulative environmental effects of multiple installations (Broomfield, 2012).

The stages are:
1. Well pad site identification and preparation
2. Well design, drilling, casing and cementing
3. Technical hydraulic fracturing stage
4. Well completion
5. Well production
6. Well abandonment.

The study identified a number of issues as presenting a high risk for people and the

environment. These issues and their significance are summarised in the following table. It is likely that these same risks apply to CSG drilling in Australia and NSW.

Table ES1: Summary of preliminary risk assessment

Environmental aspect	Project phase						
	Site identification and preparation	Well design drilling, casing, cementing	Fracturing	Well completion	Production	Well abandonment and post-abandonment	Overall rating across all phases
Individual site							
Groundwater contamination	Not applicable	Low	Moderate-**High**	**High**	Moderate-**High**	Not classifiable	**High**
Surface water contamination	Low	Moderate	Moderate-**High**	**High**	Low	Not applicable	**High**
Water resources	Not applicable	Not applicable	Moderate	Not applicable	Moderate	Not applicable	Moderate
Release to air	Low	Moderate	Moderate	Moderate	Moderate	Low	Moderate
Land take	Moderate	Not applicable	Not applicable	Not applicable	Moderate	Not classifiable	Moderate
Risk to biodiversity	Not classifiable	Low	Low	Low	Moderate	Not classifiable	Moderate
Noise impacts	Low	Moderate	Moderate	Not classifiable	Low	Not applicable	Moderate – **High**
Visual impact	Low	Low	Low	Not applicable	Low	Low-moderate	Low - Moderate
Seismicity	Not applicable	Not applicable	Low	Low	Not applicable	Not applicable	Low
Traffic	Low	Low	Moderate	Low	Low	Not applicable	Moderate
Cumulative							
Groundwater contamination	Not applicable	Low	Moderate-**High**	**High**	**High**	Not classifiable	**High**
Surface water contamination	Moderate	Moderate	Moderate-**High**	**High**	Moderate	Not applicable	**High**
Water resources	Not applicable	Not applicable	**High**	Not applicable	**High**	Not applicable	**High**
Release to air	Low	**High**	**High**	**High**	**High**	Low	**High**
Land take	**Very high**	Not applicable	Not applicable	Not applicable	**High**	Not classifiable	**High**
Risk to biodiversity	Not classifiable	Low	Moderate	Moderate	**High**	Not classifiable	**High**
Noise impacts	Low	**High**	Moderate	Not classifiable	Low	Not applicable	**High**
Visual impact	Moderate	Moderate	Moderate	Not applicable	Low	Low-moderate	Moderate
Seismicity	Not applicable	Not applicable	Low	Low	Not applicable	Not applicable	Low
Traffic	**High**	**High**	**High**	Moderate	Low	Not applicable	**High**

Not applicable: Impact not relevant to this stage of development
Not classifiable: Insufficient information available for the significance of this impact to be assessed

(Broomfield, 2012)

This suggests there are health and environmental risks from: surface and groundwater contamination; from noise impacts; from increased traffic; and from the release of air contaminants. These risks to health are not being taken in account in the consideration of project approvals nor are they being monitored during project operations.

The health and wellbeing of the community must not be sacrificed in the pursuit of these resources for energy production.

Chemicals used in 'fracking'

"Communities living near hydrocarbon gas drilling operations have become de facto laboratories for the study of environmental toxicology." (Bamburger and Oswald, 2012, pp. 51,52)

There is no current requirement for companies to declare the chemicals being used in 'fracking'. Very few of the chemicals known to be used in coal seam gas mining have been evaluated for their health effects (Carey, 2012). Some of the chemicals used in coal seam gas mining are associated with hormonal disruption, effects on fertility and reproductive systems and are potentially carcinogenic. Other chemicals are associated with damage to kidneys, and harm to the nervous system as well as carrying respiratory and cardiovascular risks (Shearman, 2011).

CSG companies frequently infer safety of these products due to the fact some are components of household products. "However just because we may have hair bleach or antifreeze in the cupboard does not mean it is safe to drink it" (Carey, 2012).

Those chemicals that are known to be in use pose serious risk to health. Some of the hazardous chemicals reported to be used in Australian fracking operations, include ethylene glycol, glutaraldehyde, fumaric acid and 2-butoxyethanol. Ethylene glycol, for example, is used to make anti-freeze. When it breaks down in the body, it forms chemicals that crystallise and collect in the kidneys and can affect kidney function. It can also form acidic chemicals in the body affecting the nervous system, lungs and heart (Carey, 2012, cites 14. ATSDR. Ethylene glycol http://www.atsdr.cdc.gov/tfacts96.Pdf).

The debate has failed to focus on these important issues because industry has placed the onus of proof of contamination on exposed communities. It has refused on many occasions to disclose what chemicals are actually used in fracking, and has **circulated information** inaccurately suggesting the procedure **uses only benign substances** (Shearman, 2012).

This needs to change – the disclosure of chemicals being used must be mandated in order to allow proper assessment of their impacts on human health.

Coal seam gas and water and land – health implications

There are impacts on both water quantity and water quality associated with coal seam gas mining.

Extraction of methane from coal seams requires the extraction of large quantities of water. The requirements for water and the process for fracking can lead to the depletion of underground aquifers, cause soil subsidence and also bring large qualities of salt to the surface, which may harm water quality (SBS, 2012). This may also lead to unanticipated releases of gases such as methane through adjacent water supplies, as is thought to be occurring in the Condamine River in Qld (Mudd, 2012).

Contamination of water tables by both methane and by fracking chemicals is possible (Smith et al., 2013). A fundamental public health issue is the potential for water contamination by chemicals which could seriously affect human health decades after exposure. Health impacts may arise from the use of fracking chemicals or from the release of hydrocarbons and other contaminants from the coal seams (Shearman, 2011).

Coal seam gas exploration also poses risk to food security, through displacement of food production from fertile agricultural land, and threats to surface and groundwater.

There is potential for serious mental health impacts among farming communities associated with the acquisition of land for coal seam gas mining, with adverse impacts on land value and grazing and cropping potential following the introduction of CSG processes (Flynn, 2012).

Further, mental health impacts are also severe on Indigenous peoples whose important cultural heritage sites and sacred sites are being, or are at risk of being damaged by CSG drilling, the associated dewatering of watercourses and ground subsidence. It is important to ensure that the pursuit of short term profits from gas do not risk inadvertently sacrificing cultural treasures which have hitherto survived for millennia.

Air pollution from CSG drilling

The air **emissions from unconventional gas activities also pose health risks.** While little monitoring has been done of air quality around Australian gas fields, high levels of toxic air contaminants have been found around US gas operations, including acrylonitrile, methylene chloride, benzene and hydrogen sulphide – which pose risks of cancer, as well as nervous system and respiratory damage (Lloyd-Smith & Senjen, 2012).

Air pollution associated with coal seam gas exploration and mining with potentially serious health risks has been demonstrated in a 2012 study, where 44 hazardous air pollutants were detected at gas drilling sites (Colburn et al., 2012). This 12 month study found a wide range of toxic air pollutants in proximity to unconventional gas exploration sites, including methane, methylene chloride, ethane, methanol, ethanol, acetone, and propane, formaldehyde, acetaldehyde, polycyclic-aromatic hydrocarbons and naphthalene. (National Toxics Network, 2013)

In Tara, Queensland, it appears that the high recorded levels of fugitive methane may reflect the presence of pollutants which are **causing illness** in local communities. Similar symptoms are being investigated by the USEPA (Shearman, 2012).

It is vital that regulatory action is taken to ensure that any health effects are prevented by assessing health risk prior to the expansion of this industry and careful monitoring is undertaken to detect any health effects.

> *"Public health experience indicates that in a range of environmental contamination issues prevention is the mainstay to protection. Think of **lead** or asbestos for example; adequate **assessment and regulation** are key measures."*
>
> (Shearman, 2012)

Other precedents exist: in the United States, control measures determined by the US EPA in response to elevated levels of pollutants measured in several gas fields will be phased in by January 2015 (Shearman, 2011).

A US exploratory study designed to assess air quality in a rural western Colorado area sampled air quality before, during and after drilling and hydraulic fracturing of a new natural gas well pad (Colborn, 2012). In this study methylene chloride, a toxic solvent not reported in products used in drilling or hydraulic fracturing, was detected 73% of the time, several times in high concentrations.

A literature search of the health effects of the NMHCs revealed that many had multiple health effects, including 30 that affect the endocrine system, which is susceptible to chemical impacts at very low concentrations, far less than government safety standards.

Selected polycyclic aromatic hydrocarbons (PAHs) were at concentrations greater than those at which prenatally exposed children in urban studies had lower developmental and IQ scores.

The authors recommend further examination of the human and environmental health impacts of the NMHCs, which are ozone precursors, given that the natural gas industry is now operating in close proximity to human residences and public lands (Colborn et al., 2012).

Natural gas and climate change

There is emerging evidence that the climate impacts of gas may be being underestimated, and that the greenhouse gas emissions from gas, particularly unconventional gas, may be much higher than reported levels (Santos & Maher, 2012).

Life cycle analyses of natural gas production, especially from unconventional sources such as coal seam and shale, suggest that the climate impact of this energy source (when accounting for methane leakage during production) may be far less advantageous than initially thought.

Leaked methane contributes to ozone formation with associated adverse health impacts. Other health concerns arise from hydraulic fracturing (“fracking”), which entails high-pressure injection of a mixture of water, sand, and chemicals into underground rock formations (Smith et al., 2013).

Gas from shale deposits (and similarly in Australia, from coal seam deposits) is estimated to have a higher greenhouse signature than coal, and if developed as predicted, may increase the proportion of US methane emissions by 40% to 60% or more over the next two decades (Howarth, 2012).

In direct contradiction to earlier speculation, scientific evidence is growing increasingly strong that gas may be an obstacle rather than a bridge to a cleaner energy future, producing higher ‘lifecycle’ greenhouse emissions even than coal. (Howarth, 2012 cited in Carey, 2012, Dangerman and Schellnhuber 2013).

Studies the United States, which has a longer history of unconventional gas extraction, including use of horizontal drilling and hydraulic fracturing techniques, indicate that industry and often government agencies seriously under-recognise the actual and potential risks to human and

environmental health of natural gas and unconventional gas drilling (Bamberger and Oswald 2012, Mitka, 2012, Broomfield, 2012).

A recent paper prepared for the US National Climate Assessment indicates methane from gas exploration and production accounts for 40% of anthropogenic greenhouse gas emissions in the US, considerably higher than the 10% reported by the US EPA in 2010 (Environmental Protection Authority).

A study by Bamberger and Oswald (2012) across six states affected by gas drilling documented cases in each states strongly implicating exposure to gas drilling operations in serious health effects on humans, companion animals, livestock, horses, and wildlife. Because animals often are exposed continually to air, soil, and groundwater and have more frequent reproductive cycles, animals may act as 'sentinels' to indicate possible impacts for human health.

They found that all phases of hydrocarbon gas production involve complex mixtures of chemical substances, with varying degrees of risk for human, animal and environmental health and safety. However, they found that complete evidence regarding health impacts of gas drilling cannot be obtained due to incomplete testing and disclosure of chemicals, and nondisclosure agreements.

These facts bring in to question the contention that gas extraction and livestock farming can coexist, and means effective livestock health and produce testing should be part of mandatory health and environmental monitoring, before, during and post-drilling operations.

"Without rigorous scientific studies, the gas drilling boom sweeping the world will remain an uncontrolled health experiment on an enormous scale (Bamberger and Oswald, 2012, p 52)."

Need for more research

Despite the substantial evidence of significant harm to human health associated with CSG and other unconventional gas, there is a lack of systematic epidemiological research on the issue both globally and in Australia, which currently limits comprehensive understanding about the full extent of harm being caused, both directly and indirectly.

In particular the impacts on human health, including mental health, arising from the mining, transportation and combustion of CSG should be evaluated in all affected communities. This should include an assessment of the economic costs associated with the adverse health impacts from this type of pollution.

The impacts on health from CSG associated processes should also be evaluated, and the monetised value of the health benefits associated with not exploiting CSG and other unconventional sources of gas evaluated for each of Australia's major unconventional gas fields.

Cost benefit analysis of this new industry should consider not only the economic up-side of exploration, extraction, use and export of unconventional gas but also the downside in terms of loss of property values and health impacts, in both the immediate and long term contexts, when the current industry and government players may no longer be around.

A study by Bamberger and Oswald (2012, p 72) concluded that: "Without complete studies, given the many apparent adverse impacts on human and animal health, a ban on shale (sic) gas drilling is essential for the protection of public health."

"Although the lack of complete testing of water, air, soil and animal tissues hampers thorough analysis of the connection between gas drilling and health, policy changes could assist in the collection of more complete data sets and also partially mitigate the risk to humans and animals. The study recommended a ban on (shale) gas drilling, but stressed that where gas drilling is being allowed, the use of commonsense measures to reduce the impact on human and animals must be required in addition to full disclosure and testing of air, water, soil, animals, and humans." (Bamberger & Oswald, 2012).

Claims that gas is "clean energy" should be viewed with caution. There is emerging evidence that the emissions from gas are much higher than reported levels, with a recent paper indicating gas accounts for 40% of anthropogenic greenhouse gas emissions in the US. (Howarth, 2012) New methods for evaluating methane emissions from gas have produced a two fold increase in reported emissions from the gas industry in the US (Howarth, 2012)

The actual emissions from coal seam gas exploration and extraction need to be thoroughly evaluated in Australia.

Health sector concerns

There is a growing understanding among health professionals that 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, and at a whole population level, through climate change impacts.

In a statement released on 13 February 2013, a large number of professional health groups[1]** in Australia have announced their intention to work together collaboratively to highlight the adverse health impacts and environmental damages associated with current minerals energy policy,

[1]http://www.phaa.net.au/documents/130213Media%20Release_Health%20and%20Energy%20Roundtable%20Statement_Final_130213.pdf

** Signed by the Public Health Association of Australia (PHAA), Climate and Health Alliance (CAHA), National Rural Health Alliance (NRHA), Climate Change Health Research Network (NCCARF-ARN), Australian Healthcare and Hospitals Association (AHHA), Cancer Council Australia, Heart Foundation, Australian Research Alliance for Children and Youth (ARACY), National Toxics Network (NTN), Australian Physiotherapy Association (APA), and NSW Nurses and Midwives' Association (NSWNMA).

particularly those relating to coal and coal seam gas.

The joint statement followed a Health and Energy Roundtable hosted by the Public Health Association of Australia (PHAA), the Climate and Health Alliance (CAHA), the National Rural Health Alliance (NRHA), the Climate Change Health Research Network (NCCARF-ARN), and the Australian Healthcare and Hospitals Association (AHHA).

This statement pointed to a lack of monitoring and inadequate investment in research which means there is grossly insufficient data available in Australia on health impacts to inform policy decisions.

Research from international sources suggests major cause for concern for human health in terms of exposure to pollution of water and air – these impacts need to be evaluated here in Australia. (Joint Statement 2013 - see Appendices)

Conclusion

The expansion of coal seam gas exploration in Australia, with its potential for high levels of greenhouse gas emissions, poses the threat of increasing the risk of dangerous climate change.

Communities living and working in proximity to CSG drilling, processing and transportation are being exposed to toxic air, water, and soil pollution, as well as severe mental health impacts.

Without comprehensive studies, given the many apparent adverse impacts on human and animal health, a ban on CSG gas drilling is essential for the protection of public health.

Until complete testing of water, air, soil and animal tissues can be systematically conducted to allow thorough analysis of the connection between gas drilling and health, policy changes should adopt the precautionary principle. Environmental analysis and detailed human health analysis of neighboring “pristine” unexplored localities should be compared to existing CSG sites and their local communities.

CAHA recommends a ban on CSG drilling, but stresses that where gas drilling is being allowed, the use of commonsense measures to reduce the impact on human and animals must be required in addition to full disclosure and testing of air, water, soil, animals, and human health.

The Climate and Health Alliance is aware that there are many communities in Australia concerned about declining water and air quality, and quality of life posing risk to their health, and the health of their livestock and wildlife in regions in proximity to CSG fields or where there is establishment or expansion of CSG mining activities. There are particularly high levels of concern about excessive water extraction, aquifer depletion and pollution, and toxic water, air and ground pollution, associated with these activities.

Concerns are also being raised about loss of agricultural productivity due to land acquisition, fragmentation and disturbance of farming land; saline and other toxic soil contamination; and motor vehicle trauma risk along transport corridors, and loss of property value, recreational, cultural and aesthetic amenity.

The main CSG projects in NSW are the Camden and Gloucester Gas Projects, the Casino Gas Project in the Clarence-Moreton Basin and the Narrabri CSG Project in the Gunnedah Basin (Carey, 2012).

In the Gunnedah Basin in NSW, communities are facing large scale developments of coal mines and coal seam gas development. The local community is seeking a health impact assessment to evaluate the potential cumulative impacts of current and potential coal and coal seam gas exploration and other extractive industries on the health of the people living and working in the region.

The Climate and Health Alliance urges the Chief Scientist and Engineer to visit and conduct public hearings in these and other relevant areas to allow communities to express their concerns and share their experiences with regard to the impact of CSG on their health and well-being.

Recommendations

The Climate and Health Alliance recommends: a ban on further coal seam gas exploration and mining; an immediate requirement for open disclosure of the chemicals used in coal seam gas mining where drilling is already taking place, the implementation of health impact assessments of all communities in the vicinity of coal seam gas projects; for the development of standards for clean air, soil, and water to be developed and applied; and for comprehensive health and climate research to be conducted to evaluate the risk of adverse health outcomes and fugitive emissions during coal seam gas exploration and development.

- **Ban on CSG exploration and drilling**

No further exploration or extraction of coal seam gas should occur until rigorous studies have been undertaken and evaluated which clearly demonstrate minimal harm to health (above ground and subsurface) water, soil and air. Evaluation of risk to health, water resources, farmland and food security, local communities, natural biodiversity, cultural heritage and greenhouse emissions should be conducted prior to project approval.

- **Disclosure**

There needs to be greater transparency around the chemicals being used on coal seam gas exploration and mining. These chemicals need to be evaluated for their impacts on health in concentrations that reflect actual exposure. Regulations must be developed to require the open disclosure of all toxic substances so they can be evaluated for their effect on human health

- **Health impact assessments**

A comprehensive study of the health of the local community should be conducted prior to and during all coal seam gas development to evaluate any adverse and social impacts associated with the development. This should include health impacts related to environmental and social harms.

- **Standards, monitoring and regulation**

Australian state and territory regulations need to be expanded to ensure the impacts on health and wellbeing are being considered in planning and development decisions. In addition, improved monitoring of compliance with existing regulations is needed, and in particular, monitoring of air, water and soil quality and greenhouse gas emissions at all mining sites. In addition, the health of livestock, companion animals and wildlife needs to be monitored.

- **Research**

The risks to human health from exploration and extraction of coal seam gas need to be thoroughly evaluated using rigorous monitoring in all affected communities. This should include epidemiological studies and assessment of the impacts on air, soil and water and include the economic costs associated with adverse health impacts. Additional research needs to evaluate the potential effects of CSG exploration and extraction on underground aquifer system (nearby and distant), with specific regard to the likelihood of contamination or alteration of flow or availability. Independent scientifically valid studies should be undertaken to evaluate greenhouse gas emissions from all coal seam gas activities.

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Queensland's Department of Environment and Heritage Protection

Appendices:

APPENDIX A

Climate and Health Alliance (CAHA) Committee of Management

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Dr Bret Hart (Alliance for Future Health)
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CAHA Organisational Members

Australian Association of Social Workers (AASW)
Australian College of Nursing (ACN)
Australian College of Rural and Remote Medicine (ACRRM)
Australian Council of Social Service (ACOSS)
Australian Hospitals and Healthcare Association (AHHA)
Australian Health Promotion Association (AHPA)
Australian Medical Students Association of Australia (AMSA)
Australian Physiotherapy Association (APA)
Australian Institute of Health Innovation (AIHI)
Australian Women's Health Network (AWHN)
Australian Nursing Federation (ANF)
Australian Psychological Society (APS)
Australian Research Council for Children and Youth (ARACY)
Australian Rural Health Education Network (ARHEN)
CRANA*plus*
Doctors Reform Society (DRS)
Friends of CAHA
Health Consumers' Network (Qld)
Health Issues Centre (HIC)
Public Health Association of Australia (PHAA)
North Yarra Community Health (NYCH)
School of Public Health and Community Medicine, University of NSW
Services for Australian Rural and Remote Allied Health (SARRAH)
Women's Health East
Women's Health in the North
World Vision

Expert Advisory Committee

Associate Professor Erica Bell, University Department of Rural Health, University of Tasmania
Associate Professor Grant Blashki, Nossal Institute for Global Health
Associate Professor Colin Butler, College of Medicine, Biology and Environment, Australian National University
Professor Garry Egger, School of Health & Human Sciences, Southern Cross University
Professor David Karoly, Federation Fellow in the School of Earth Sciences, University of Melbourne
Professor Stephan Lewandowsky, School of Psychology, University of Western Australia
Dr Peter Tait, FRACGP, MClimChng, FPHAA; General Practitioner of the Year 2007; Canberra
Professor Anthony Capon, National Centre for Epidemiology and Population Health, Australian National University
Professor Simon Chapman, Professor of Public Health, University of Sydney
Dr Susie Burke, Senior Psychologist, Public Interest, Environment & Disaster Response, Aust Psych Soc

APPENDIX B

Joint statement on the health effects of Australia's minerals and energy policy
April 2013

The joint statement is signed by Public Health Association of Australia (PHAA), Climate and Health Alliance (CAHA), National Rural Health Alliance (NRHA), Climate Change Health Research Network (NCCARF-ARN), Australian Healthcare and Hospitals Association (AHHA), Cancer Council Australia, Australian Research Alliance for Children and Youth (ARACY), National Toxics Network (NTN), Australian Physiotherapy Association (APA), NSW Nurses and Midwives' Association (NSWNMA), the Australian Nursing Federation, Services for Rural and Remote Health (SARRAH), Doctors for the Environment Australia (DEA), and the Australian College of Nursing (ACN).

This statement was developed following a Health and Energy Roundtable hosted by Climate and Health Alliance (CAHA), Public Health Association of Australia (PHAA), National Rural Health Alliance (NRHA), Climate Change Health Research Network (NCCARF-ARN), and Australian Healthcare and Hospitals Association (AHHA) on 12 February 2013.

An earlier version of the joint statement was released on 13 February 2013 as the groups announced their intention to work together collaboratively to highlight the adverse health impacts and environmental damages associated with current minerals energy policy, particularly those relating to coal and coal seam gas. This version includes organisational signatories that have subsequently endorsed the statement and committed to collaborative action with the other parties to the statement.

Joint Statement
Health effects of Australia's minerals and energy policy

"The risks to human health from energy and resources policy are not being accounted for in current policy decisions.

"Significant policy reform is needed to ensure health and wellbeing is not compromised by policy decisions in other sectors. Recognising the importance of the social and environmental determinants of health is an important part of that.

"The overriding concern is that climate change is being driven by energy choices and minerals policies that privilege and prioritise the extraction and combustion of fossil fuels over safer, healthier, lower emissions, renewable energy resources.

"The local health impacts from coal mining, transportation and combustion are also a significant concern, and communities living in proximity to these activities are experiencing adverse social impacts, such as loss of amenity, displacement, and loss of social capital as well as facing increased risks of respiratory disease, heart disease, and lung cancer.

"The rapid expansion of the fossil fuel (coal and unconventional gas) industries in Australia demands these issues be urgently addressed.

"There are serious concerns raised about the availability of data and support for health research on this issue.

"A lack of monitoring and inadequate investment in research means there is grossly insufficient data available in Australia on health impacts to inform policy decisions. Research from international sources suggests major cause for concern in terms of exposure to pollution of water and air – these impacts need to be evaluated here in Australia.

"The health impacts of minerals and energy policy must be an area of research priority that is given significant levels of independent funding, and there needs to be greatly increased surveillance and monitoring to ensure sufficient data collection on which to base this research.

"There is a need for education for health professionals and the community more broadly around the health implications of energy policy choices, health professionals across all disciplines are encouraged to advocate for minerals, energy and climate policies on the basis of health.

"Health professionals have an important role to play in educating decision makers and the community about the health implications of energy choices and the health implications of climate change.

"The local and global effect of fossil fuel use on health and wellbeing is an immediate problem as well as an issue of intergenerational equity, with the exploitation of these resources causing irreversible harm to Earth's systems, compromising the health and security of future generations."

APPENDIX C

Dealing with the health risks of unconventional gas

The Conversation 28 Nov 2012
By David Shearman, Emeritus Professor of Medicine (University of Adelaide)
http://theconversation.com/dealing-with-the-health-risks-of-unconventional-gas-10987

Community concerns over unconventional gas (shale and coal seam) mining in Australia are increasing. These concerns relate to water and air pollution, land usage, fugitive emissions and to inadequate assessment and regulation. The environmental impacts have potentially serious human health consequences.

In 2010, Doctors for the Environment Australia first **raised concerns** about the potential health impacts of coal seam gas mining in Australia. We subsequently detailed these concerns in a **submission to the Senate** and to the **NSW Parliament**.

Professor Paul Stevens, energy expert at Chatham House, provides an independent view on this issue. He **reviewed CSG in 2010**; in 2012 he noted that disappointing outcomes had **reduced the hype**.

What could go wrong for public health?

Coal seam gas trapped in coal seams is the predominant form of unconventional gas in NSW and Queensland. **Shale gas** is trapped in shale formations; this is the predominant form in the US, and in Australia it has been located in the Cooper Basin in Central Australia. Proponents of coal seam gas mining often seek to draw distinctions from shale gas mining in order to play down the adverse impacts of shale mining reported in the US. In fact the public health concerns exist to varying degree with both forms of mining.

The fundamental public health issue is the potential for water contamination by chemicals which could seriously affect human health decades after exposure. Health impacts may arise from the use of fracking chemicals or from the release of hydrocarbons and other contaminants from the coal seams.

Pollutants – particularly volatile organic compounds – may be released into the air at the well head. In the United States, control measures determined by the US EPA in response to elevated levels of pollutants measured in several gas fields will be **phased in by January 2015** In Tara, Queensland, it seems possible that the high recorded levels of fugitive methane may also reflect the presence of pollutants which are **causing illness** in local communities – similar symptoms are under investigation by the USEPA.

Public health experience indicates that in a range of environmental contamination issues prevention is the mainstay to protection. Think of **lead** or asbestos for example; adequate assessment and regulation are key measures.

The debate has failed to focus on these important issues because industry has placed the onus of proof of contamination on exposed communities. It has refused on many occasions to disclose what chemicals are actually used in fracking, and has **circulated information** inaccurately suggesting the procedure **uses only benign substances**.

Australia's regulatory failures

Australia should have learned from the US 2005 Energy Act, which excluded fracking from the Environmental Protection Agency's (EPA) Clean Water Act. This clause – which has become known as the "**Cheney-Halliburton loophole**" – meant that many shale gas operations began without a proper environmental impact assessment. Because they had no measurement of the "baseline", they could not be properly assessed after the event either.

In Australia, baseline studies on aquifer water and air quality have not been done before CSG mining development. This is a failure of regulation in states.

The second and related failure is in chemical assessment of fracking chemicals by the National Industrial Chemicals Notification and Assessment Scheme. Some assessment of chemicals is taking place after their widespread use and there is no national uniform means of imposing regulation. Assessment is just beginning, may take years, and there is no uniform requirement for disclosure. This is federal failure.

The third failure resides in the disparate and inadequate assessments in all states apart from SA, which has not yet completed its regulatory review. Despite potential environmental and health impacts, proper processes have been avoided by most states. A recent example of how the states should be made aware of the potential health issues is provided by the report from the Chief Medical Officer of Health of the **province of New Brunswick in Canada**, which details what every operator and regulator should know about the public health aspects of unconventional gas mining.

The Federal Government must take the lead

The fourth failure is that of the Federal Government, which should seek mechanisms to impose order and safety on the states. The tenuous access to Commonwealth regulation was to be through the **EPBC Act** via regulation of water. An **Expert Committee** has been formed to advise on the scientific aspects of CSG mining, but on track record, its advice is unlikely to be taken by the states. Other federal mechanisms will need to be sought.

However, it raises the vital question as to why the Federal Government under COAG proposals is likely to hand more environmental and therefore health regulation to the states.

Many health concerns could be allayed by tight regulation of mining technology, pre-emptive water analysis, monitoring for both water contamination and health impacts. Indeed it would be in the interests of industry to welcome such measures and promote them instead of **spending large sums** reassuring the public.

Finally what about regulation of the biggest potential health impact? The International Energy Agency has **expressed concern** about gas replacing renewable energy sources. This would delay any chance of early curtailment of greenhouse emissions. Climate change is accepted as a **huge threat to health** world-wide.

In 2012, unconventional gas mining is expanding rapidly. Billions of dollars are being invested without adequate research, regulation and public health surveillance. We are trusting that the lucky country will get away with it. And as with coal the **externality costs** with be foisted onto to the public purse.

APPENDIX D

SCU releases first independent methane observations in Australian CSG fields – Media Release 15/11/2012

Submission 'Fugitive Emissions from Coal Seam Gas' By Dr Isaac Santos and Dr Damien Maher, Centre for Coastal Biogeochemistry Research, Southern Cross University

Preliminary research conducted by Southern Cross University shows methane concentrations collected around the Tara gas fields in Southern Queensland are significantly higher than surrounding areas where there is no coal seam gas infrastructure. Dr Isaac Santos and Dr Damien Maher from the University's Centre for Coastal Biogeochemistry Research in the School of Environment, Science and Engineering presented their research at a public lecture in Lismore on November 14, 2012.

Southern Cross University has rejected claims the research was premature or lacking in scientific rigour as claimed by industry group, Australian Petroleum Production & Exploration Association Ltd. The University has world leading expertise in the field of geochemistry, achieving the highest rating of 5 'well above world standard' in this field in the Excellence in Research for Australia 2010 report. Dr Santos said their scientific results were currently being peer reviewed by an international scientific journal.

"Despite commercial production starting in the mid-1990s, this is the first publicly available data on concentrations of methane in the atmosphere of Australian CSG production areas. "We used cutting edge technology to make the measurements. Our work highlights the need for further research to adequately quantify the emissions and their source," Dr Santos said.

Dr Santos and Dr Maher produced the first independent maps of atmospheric methane concentrations in CSG production fields in Australia in an effort to determine whether gases may be leaking from CSG infrastructure. Methane is the dominant gas in CSG. The scientists surveyed methane concentrations in air and water samples in two areas: the CSG mining fields around Tara in Southern Queensland, and CSG exploration activity in the Richmond River catchment around Lismore in Northern **New South Wales**.

Typically background concentrations of methane in the atmosphere are approximately 1.8 parts per million. But Dr Maher said concentrations of methane were much higher in the atmosphere and waterways around Tara than in the Lismore area. "In Tara the concentrations are consistently higher than two parts per million and approach seven parts per million in a few locations. This is about three and a half times higher than expected if there was no change in the atmosphere. "These results are higher than values reported for conventional gas production fields in Siberia, one of the world's largest natural gas production areas," said Dr Maher.

Dr Santos said there were two explanations for the increases: fugitive emissions caused by methane escaping from CSG activities or natural seepage. "Any geological area that has gas deposits is going to have natural seeps. At this stage we are unable to separate the contribution of CSG activities from natural seeps because **no sampling was done in Tara prior to mining**.

“Our research highlights the need for sampling and baseline studies to be established before changing the environment. These baseline studies are the best and perhaps the only way to fully assess change potentially brought about by any industry,” said Dr Santos.

Dr Maher said while CSG may have been promoted as a clean energy source, no independent studies had quantified the whole gas field methane output from Australian CSG fields. “This is clearly the next step. Methane is a powerful greenhouse gas, at least 25 times more powerful than carbon dioxide. Given fugitive emissions are not directly measured at this stage, follow-up quantitative research could potentially change carbon tax estimates for the CSG industry.” Currently CSG fugitive emissions estimates have not been assessed by independent organisations.

“Typically in Australia we assume a figure of 0.12 per cent leakage at the wellhead of total gas production but we don’t have any data backing up that assumption. Some studies overseas indicate that lifecycle fugitive emissions may be up to eight per cent,” Dr Maher said. “While the figure of eight per cent has come under fire by some academics and the CSG industry, the lack of baseline data makes it extremely difficult to put an exact number on mining-specific emissions after mining has commenced. We don’t know what fugitive emissions are coming from Australian CSG mining. “We need to do site specific experiments to quantify those emissions for every gas field.”

Dr Santos said industry currently had a ‘fire detector’ approach to methane. “A ‘fire detector’ approach to methane regulation means methane is treated as an explosive hazard only. Concentrations have to reach explosive levels to be considered a problem. “Our results indicate that we should adopt more of a ‘smoke detector’ approach in which methane is treated as a powerful greenhouse gas. By using this approach minor leaks over a large area should be accounted for.”

SCU’s Centre for Coastal Biogeochemistry Research The research by Dr Santos and Dr Maher builds on Southern Cross University’s strengths in the field of geochemistry. In 2010, SCU was given the highest rank of 5 ‘well above world standard’ in the Excellence in Research for Australia (ERA) 2010 report. SCU’s ERA rank in the field of geochemistry is matched by only other two universities in Australia.

BIOs: Dr Isaac Santos is a world leader in groundwater research and the Deputy Director of the Centre for Coastal Biogeochemistry at SCU. Dr Santos has 50 scientific peer reviewed publications, many of which focus on the hydrology and chemistry of the Richmond River. In 2011 Santos was given an award from the Coastal and Estuarine Research Federation, the largest global federation of coastal scientists for his research on groundwater. Dr Damien Maher is an expert in carbon dioxide cycling in the environment. He has published the first scientific papers estimating carbon dioxide fluxes in Australian estuaries. Dr Maher has recently developed a rapid approach to perform high precision methane measurements in air and water.

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