## EXECUTIVE SUMMARY

1. **Introduction**
   It is time to reduce carbon emissions, and reduction over the next 20 years is the critical period in which global warming needs to be limited to 2°C.

2. **THE ENVIRONMENTAL, LAND PRODUCTIVITY AND PUBLIC HEALTH RISKS, RISK MITIGATIONS AND RESIDUAL RISKS OF ONSHORE GAS ACTIVITIES**
   Multiple risks especially increase in greenhouse gas emissions, fire risk, water supply, public health.

3. **COEXISTENCE OF ONSHORE UNCONVENTIONAL GAS ACTIVITIES WITH EXISTING LAND AND WATER USES, IMPLICATIONS FOR INVESTMENT AND JOBS**
   Importance of Victoria's food bowl, adequacy of water for agriculture, potential conflicts and pressure on resources, industry claims for increased employment far greater than shown by ABS.

4. **THE ABILITY OF POTENTIAL ONSHORE UNCONVENTIONAL GAS RESOURCES CONTRIBUTING TO THE STATE'S OVERALL ENERGY SOURCES INCLUDING –(a) an ability to provide a competitive source of energy and non- energy inputs for Victorian industry and (b) an affordable energy source for domestic consumers;**
   Gas will become more expensive as domestic prices are linked to world parity price.

5. **THE RESOURCE KNOWLEDGE REQUIREMENTS AND POLICY AND REGULATORY SAFEGUARDS THAT WOULD BE NECESSARY TO ENABLE EXPLORATION AND DEVELOPMENT OF ONSHORE UNCONVENTIONAL GAS RESOURCES**
   Growing evidence that regulations are not capable of preventing harm due to constant increase of infrastructure, number of wells and subterranean geological landscape. Methane migration, and chemical contamination of air and water supplies. Political protection of the industry in the USA facilitated its growth. Need for reform and transformational change to renewable energy.

6. **CONCLUSION**
   New York State department of Environmental Conservation found that prohibition of fracking is the safest pathway to protect the environment, public health, economic and social considerations.
   IPCC finds that substantial and sustained reductions in greenhouse gas emissions, together with adaptation, can limit climate change risks.

**Inquiry into Unconventional Gas in Victoria.**

Thank you for the opportunity to submit to this Inquiry. I am a grandmother, my background is in Community Development and Adult Education, and I am interested in democracy and good governance. I hope for a peaceful future and recognise the need for a broad suite of constructive, responsible policies, decisions and actions to achieve same. I am concerned that, confronted by global warming as we are, my little grand daughters' generation should have a healthy environment and a peaceful society in their adulthood. It is hard to see our own future, but easier to see ahead for children as each of us knows how soon we became adults. Thus we hold responsibility for their future. Being a grandmother I am aware of changes that have taken place over recent generations, of how the consequences of actions reveal themselves, therefore the importance of taking the time and effort to make wise decisions on fundamental issues.

The environment is fundamental to human life. A significant recent report, "What Australia Knew and Buried"(Taylor 2014) reminds us that in 1990 Australia was leading the world in community education on global warming, and then charts the unfortunate policy influence and linkage between governments, the think-tanks supported by the fossil fuel industry, and corporate media that has led to the dismantling of this knowledge and has placed Australia in the misbegotten position of being vulnerable to, and unprepared for, climate change. By the 1990s "peak oil" was already forecast, as was the likelihood of the fossil fuel industry embarking upon more dangerous and risky extraction methods to maintain their business model, of which unconventional gas mining is a prime example. In the USA the fossil fuel industry chose to protect its business model despite the known negative consequences, as outlined in "The Climate Deception Dossiers". The important journey towards renewable energy and reduced consumption which citizens, industry and governments could otherwise have worked towards over the last three decades was delayed and we now face a far riskier future (Mulvey, Shulman et. al. 2015). As recently as 9 July 2015, at an international UN gathering of scientists in Paris, Professor Thomas Stocker, climate physics expert at Bern University, has stated that "At current emissions, we have a time window of about 20 to 25 years until that budget (of emissions consistent with 2°C) is exhausted". To achieve climate safety, emissions will have to drop 40-70% between 2010 and 2050, and to zero by 2100. To reduce climate risks "necessitates a transformation in the energy sector from emissions intensive coal, gas and oil to more sustainable sources like solar and wind". Even at 2°C warmer, the world will be a more hostile place. (Twomey 2015). With resolve, we all must now make decisions congruent with the path to a safer future.

In Victoria we have the opportunity to learn from the deleterious impacts of the coal seam gas industry in the USA, Queensland, and elsewhere. Exploration licences have been issued on 85% of Gippsland's prime agricultural land, a million hectares of the Western District, and even some around the Murray River, all of which are in ongoing need of protection.

We find ourselves faced with the possibility of additional destruction of the Victorian environment, water resource and agricultural land – for a business model of short term gas export in free trade deals – and I appreciate the efforts of this inquiry to consider the risks and their scientific context.

**(2) THE ENVIRONMENTAL, LAND PRODUCTIVITY AND PUBLIC HEALTH RISKS, RISK MITIGATIONS AND RESIDUAL RISKS OF ONSHORE GAS ACTIVITIES**

Known consequences of unconventional mining identified by the Australian Council of Learned Academies include :-

- Habitat destruction and fragmentation by partial or complete clearing of vegetation, and consequent effects on biodiversity;
- Impacts on landscape function and on competing current and future land uses;
- Impacts on drainage lines, flow regimes, volumes of surface waters and ground water systems from water extraction and disposal, and new infrastructure with implications for terrestrial and groundwater dependent ecosystems;
- Contamination of water quality (surface and groundwater);
- Contamination of air, soils, vegetation, including release of stored carbon, with consequent damage to terrestrial and aquatic ecosystems;
- Impacts on community amenity through traffic, noise, dust and light pollution;
- Cultural amenity of indigenous people (where mining activities are proximate);
- Spread of invasive species; (ACOLA 2013:100-101)

The Australian Council of Learned Academies notes that the terms of reference for its review did not include a consideration of cleaner renewable energy (ACOLA 2013:19). This omission removed unconventional mining from the broader context of a sustainable future.

The Union of Concerned Scientists states that "becoming too reliant on natural gas poses numerous complex risks, including persistent price volatility, climate-changing emissions from combustion and the leakage of methane, and water and air pollution from natural gas production. Our analysis shows that a wholesale shift to natural gas makes less economic sense than would prioritizing investments in renewable energy and energy efficiency". (Deyette, Clemmer et. al. 2015:1) The best mitigation of the risks of unconventional gas mining would be to prioritise investment of time and resource in development of renewable energy.

**<u>Environmental risks – greenhouse gas emissions</u>**

One major risk of unconventional gas mining is the increase in greenhouse gas emissions in the final critical period before the burden on the atmosphere is so great that unmanageable extreme weather events become commonplace. Methane is 87 times more potent as a greenhouse gas than carbon dioxide over 20 years, after which time its potency declines (Myhre, Gunner et. al. 2013:714). The active life of CSG mining is a short one, generally 20-

25 years, which means the majority of emissions from this industry would occur over the same period that climate science tells us greenhouse gas reduction is essential.

In March 2015 for the first time in all continents Carbon Dioxide was measured at over 400 parts per million (ppm). A comprehensive comment on this milestone from NASA scientist, oceanographer Dr William Patzert is worth some serious thought "Scary scorecard: catastrophic climate change 400, humanity zero. Listen to the scientists, vote wisely, beat carbon addiction and put humanity into the game".

350 ppm is considered 'safe' as at that level, it would only take a century to return to the normal rate (of around 280ppm) prior to the Industrial Revolution. The world was at 350 ppm around 1988, and it was known at that time that we were on a serious trajectory towards global warming. In the ensuing 27 years, emissions have increased by 50ppm when they should have been reducing. Enabling an additional fossil fuel industry to add to Victoria's emissions burden, at this time, would have serious consequences.

This issue is seen clearly in the UK where unconventional gas is also being debated "If any country brings any additional fossil fuel reserve into production, then in the absence of strong climate policies, we believe it is likely that this production would increase cumulative emissions in the long run" (McCoy & Saunders 2015:21). As alluded to above, in Victoria, and Australia, strong climate policies are largely absent.

Many local and state discussions on sea level rise, drainage and flooding that I have attended focus on adaptation, but mitigation is hardly mentioned. It seems that adaptation to climate change has become the new normal, as if there are no consequences. However it is ingenuous to overlook the cause of global warming, excess emission of greenhouse gas, which is still within our power to address. Billions of dollars will be required again and again for adaptation and recovery from extreme climate change events (cost of repairs in NYC after Superstorm Sandy was $65 billion (Rice 2013), but there are limits to how much chaos can be overcome. Would it not be prudent to address the cause, rather than normalise the symptoms? Rice (2013) refers to an October 2012 report from Munich Re, the world's largest reinsurance firm, on climate change having driven the increase in natural disasters since 1980, and predicting that those influences will continue in the years ahead. The IPCC (2014:17) finds that "Adaptation and mitigation are complementary strategies for reducing and managing the risks of climate change. Substantial emissions reductions over the next few decades can reduce climate risks in the 21$^{st}$ century and beyond, increase prospects for effective adaptation, reduce the costs and challenges of mitigation in the longer term and contribute to climate-resilient pathways for sustainable development". It seems that questioning the right of polluters to pollute is unfashionable, however the scale of the threat ahead of us demands that we fashion policy and practice to reduce emissions.

A major opportunity cost of investment in unconventional gas is that it potentially displaces investment in low and zero-carbon sources of energy. Step by step, the world needs to

transition to zero carbon forms of energy to avoid dangerous climate change (Gudnoff 2014:20).

Gas-fired electricity is sometimes claimed to be more efficient in terms of carbon emissions than coal fired electricity generation, but this comparison omits the life cycle emissions of gas extraction, fugitive emissions, transport, production and consumption. The Climate and Clean Air Coalition, working under the auspices of the United Nations Environment Program estimated "that over 8% of total worldwide natural gas production is lost annually to venting, leakage and flaring. In addition to US$27-$63 billion in energy and economic losses, these activities result in nearly two gigatonnes of carbon dioxide equivalent of greenhouse gas emissions p.a., over 80% of which are methane emissions – making oil and gas operations the second largest source of global anthropogenic methane emissions behind agriculture. (ACOLA 2013:140)

In regard to **long term effects of emissions** from gas wells, a study of abandoned gas wells in Pennsylvania found that continuing methane emissions appear to be a significant source of methane emissions to the atmosphere, and that the cumulative emissions from abandoned wells may be significantly larger than in the shorter lifetime of the production period (Kang, Kanno et al, 2014).

The preface to the 2013 IPCC Assessment Report (p. vii) states that "continued emissions of greenhouse gases will cause further warming and changes in all components of the climate system. Limiting climate change will require substantial and sustained reductions of greenhouse gas emissions" (IPCC, 2013). We need to heed this advice before it is, indeed, too late.

We are rapidly using up the budget of emissions set in an attempt to prevent more than two additional degrees of warming. Climate science tells us that important tipping points are likely to be triggered if the globe warms more than two degrees. Tipping points cause feedback effects that in turn cause more warming, which once begun cannot be stopped. Once we pass two degrees of warming, we may be unable to stop a further three or four degrees from occurring, even if we dramatically reduce our emissions (Gudnoff 2014:25).

## Fire Risk

Warming and drying of Victoria is forecast as climate change kicks in. The number of extreme fire risk days has grown over the past four decades, particularly in South East Australia and away from the coast. Future hotter and drier conditions, especially in southern Australia, are likely to cause further increases in the number of high fire-risk days and in the length of the fire season, to the extent that the number of fire danger days rated at 'very high' and above could double by 2050, under higher emission climate scenarios. (AAS 2015:25).

Venting and flaring in unconventional gas production means gas and/or naked flame is proximate to gas wells, available to be carried by the high winds characteristic of the worst fire days, potentially an additional source of explosive combustion to bushfires.

Enduring emissions from abandoned gas wells, as well as fugitive emissions, leakage, venting and flaring during the 20 – 25 years of active life of unconventional gas mining, indicates the need to pay attention to the ignition and explosion factor in an increasingly bushfire prone Victoria. The extraction of groundwater, and chemical pollution of that groundwater in unconventional gas mining, will further reduce the water resource available for fire fighting, as well as creating more tinder dry vegetation and explosive gaseous parched earth.

**Water Risks**

These are some of the cumulative impacts that can be expected to emerge, on water resources and land capability, as yet more land uses are added in particular areas, e.g. mining and peri-urban development added to agriculture and water storage areas.

Unconventional mining introduces a significant additional risk to the maintenance of adequate water supply as global warming occurs, and as population increases. Water is basic to human life and unconventional mining is a major user. It not only requires a massive amount of water for operations, in the USA 3 – 12 million gallons of water can be used for each well but also the EPA reports between 15,000 and 60,000 gallons of chemicals are mixed with the water used in each fracking well, and this fluid may seep into and contaminate aquifers. (A Gallon, 8 pints, is equivalent to 5 litres). Further, even in its undisturbed state, the shale, rock or coal formations being fractured are usually permeated with water that commonly includes dissolved solids, salts, metal ions, radioactive compounds, and other substances naturally occurring deep underground. Some of this 'produced water' is pumped to the surface as long as the well is producing. Thus, both drilling wastewater and produced water can be highly saline, toxic or radioactive (Haluszcak, Rose et al. 2012; Rowan et al. 2011). The collection, transportation, and storage or disposal of these fluids presents risks to industry workers and to the public (Deyette, Clemmer et al. 2015:18).

Since the mid 1990s South East Australia has experienced a 15% decline in late autumn and early winter rainfall, and a 25% decline in average rainfall in April and May. Australia is experiencing an increase in intensity and frequency of hot days and heatwaves, including severity of droughts. Average annual stream flows to Melbourne's four major water harvesting storages could decrease by 7% in 2020 and 18% by 2050. Future increases in severity of drought will impact human health, agriculture, urban water supplies and the environment (Steffen, Will, 2015).

All the above potential shortages will run parallel with an expected doubling of Melbourne's population over the next few decades. Clearly some serious re-thinking is needed to bring these challenges of increased demand and diminishing resources into better focus. While energy is a benefit, food and water are absolutely essential to human life and should not be put at risk.

**Public Health Risks**

There are serious concerns being raised with regard to the safety of chemicals used in coal seam gas mining in Australia, with potential risks of neurological, respiratory, reproductive, cardiovascular, endocrine and kidney disorders. (Armstrong et al. 2013:13)

A study of birth outcomes and maternal residential proximity to natural gas development in rural Colorado suggested a positive association between greater density and proximity of natural gas wells within a 10 mile radius of maternal residence and greater prevalence of congenital heart defects and possible neural tube defects (McKenzie, Guo et al., 2014)

A small unfunded health study was made by a concerned GP in the rural residential estates near Tara in Queensland. The author states that no baseline air or water monitoring or baseline health studies were done prior to the Queensland Government permitting the widespread development of the CSG industry in close proximity to family homes. Briefly, the report recommends comprehensive medical assessment of residents, long term epidemiological studies to track the health of people exposed to CSG, health impact assessment of any and every unconventional gas development, comprehensive air and water monitoring, full and open disclosure by gas companies in a timely manner of all chemicals, and all quantities of chemicals. The author states the need for the federal government to develop legislation to protect public health across Australia from the impacts of unconventional gas development and other extractive industries, and for open, fully informed public debate on the future of the unconventional gas industry in Australia. (McCarron, Geralyn 2013:1of2, 2 of2)

A major public health study was conducted into High Volume Hydraulic Fracturing (HVHF) in New York State and its findings were the basis of a ban on the practice announced by Governor Cuomo in December 2014. The study found that "The current scientific information is insufficient. Furthermore, it is clear from the existing literature and experience that HVHF activity has resulted in environmental impacts that are potentially adverse to public health. Until the science provides sufficient information to determine the level of risk to public health from HVHF and whether the risks can be adequately managed, HVHF should not proceed in New York. (NYSDOH 2014:88)

**Economic Risks**

A recent Working Paper for the IMF (Coady, Parry et. al 2015) "How Large Are Global Energy Subsidies?" was reported in the Guardian by Damian Carrington (2015) who stated that "fossil fuel companies are benefitting from global subsidies of $5.3tn a year, equivalent to $10m a minute, every day. This figure is greater than the total health spending of all the world's governments, and is largely due to polluters not paying the costs imposed on governments by the burning of coal, oil and gas. These costs include the harm caused to local populations by air pollution, as well as to people across the globe affected by the floods, droughts and storms being driven by climate change".

The IMF is reported as stating that "ending subsidies for fossil fuels would cut global carbon emissions by 20%, which would be a giant step towards taming global warming. It would also slash the number of premature deaths from outdoor air pollution by 50% - about 1.6 million lives a year". Further, the IMF view said "the resources freed by ending fossil fuel subsidies could drive economic growth and poverty reduction through greater investment in infrastructure, health and education, and also by cutting taxes that restrict growth".

Subsidies to fossil fuel industry distort its true costs. Bridle and Kitson state that the impact of fossil fuels on renewable energy development can be broken down into four key aspects, which have some overlap.

1. Subsidies of fossil fuel impair the relative cost competitiveness of renewable energy by reducing the cost of fossil-fuel-based alternatives.
2. Many electricity systems are based on fossil-fuel generation, so fossil-fuel subsidies act to lock in incumbent generation technologies, thereby imposing entry barriers for new entrants attempting to develop renewable technologies.
3. A shift to an electricity system including a greater role for renewable energy requires investment, which is undermined by fossil-fuel subsidies that appear to enhance attractiveness of fossil-fuel technologies compared with renewable energy.
4. The underpricing of environmental and social externalities means that prices do not reflect the true cost of energy.

Most of the above describe external costs, costs associated with production that are not charged to the producer and are instead experienced by society as a whole. For fossil fuel generation, these external costs include the social and environmental cost associated with local air pollution, greenhouse gas emissions, public health and social disruption. In turn, these external costs can be seen as a further cost of the massive traditional public subsidies to the fossil fuel industry, and those external costs would be greatly reduced if renewable sources of energy were subsidised instead. (Bridle and Kitson 2014:5)

Public subsidies seem to be a significant underpinning to the fossil fuel industry's ability to seek further investment (despite it being one of the world's largest profit makers) and yet

further exploration is heading in the direction opposite to the one climate science tells us is necessary for a sustainable future. This is the arena of governance. Critical choices made on behalf of society should reduce the risks associated with climate change. (AAS 2015:31)

Further the fossil fuel industry seems not to be a great corporate citizen as far as tax is concerned either. The oil and gas industry pays relatively low rates of tax and its high rates of profit mostly flows overseas to foreign owners (Gudnoff 2014:41-42).

**(3) COEXISTENCE OF ONSHORE UNCONVENTIONAL GAS ACTIVITIES WITH EXISTING LAND AND WATER USES, INCLUDING**

**(a) agricultural production and domestic and export market requirements**

On a level playing field, Victoria is a significant food and dairy bowl for Australia. Exploration licences for unconventional gas mining in Victoria are almost entirely on agricultural land.

Unconventional gas mining and agriculture are both highly dependent on access to water, and as stated above, water availability will be less, and demands will be greater from the forecast population growth.

With the additional complication of recent free trade agreements, in particular one guaranteeing a supply of dairy to China, and another guaranteeing a supply of gas to Japan, the level playing field becomes a new ballgame altogether. Potentially both industries could compete for resources in the same areas, yet gas mining cannot co-exist with food production of high quality. There is further concern for adequacy of planning and regulation around the as yet unrevealed content of the Trans Pacific Partnership which could potentially enable corporate interests to take precedence over public rights through the Investor State Dispute Settlement clause.

“Chief among the potential threats to health is the contamination of surface and ground waters, particularly drinking water sources. The chemical additives used in fracking, their degradation products, and compounds mobilised from sediments during the process can pose a risk to animal and human health by contaminating water used for drinking, washing, stock watering and food production. These can include toxic, allergenic, mutagenic and carcinogenic substances as well as methane. Waste water coming to the surface may contain volatile organic compounds, high concentrations of ions, heavy metals and radioactive substances.

The CSG industry uses enormous quantities of water, with predicted extractions of around 7500 gigalitres (a gigalitre is 1,000,000,000 litres) over the next 25 years. The National Water Commission is concerned that “CSG development represents a substantial risk to sustainable water management”
(http://www.nwc.gov.au/data/assets/pdf_file/0003/9723/Coal_Seam_Gas.pdf

ACOLA (p. 78) concurs that access to sufficient water supplies for unconventional mining may become an issue. Around 4 to 22 megalitres of water per well is required, depending on the number of "fracks". A single frack requires approximately 500,000 litres of water (around 15 truckloads), and there can be 10 – 20 fracks per well.

In a water-constrained future, the volume of water required, and the method of transporting it to well sites (whether by truck, by pipeline or by groundwater extraction infrastructure) offers many problems, great expense and undesirable outcomes for local communities as well as the population generally.

"In any circumstance, and especially in a drying continent, groundwater extraction needs to be controlled. The whole natural water system is connected and integrated – wetlands, springs, rivers, groundwater and ocean. Where pumping effect on connected systems is ignored the risk is unreliable water supplies, drying rivers and damaged ecosystems. Groundwater laws are needed to define harm and set thresholds. Licences to control extraction and prevent harm need to consider thresholds. Any harm from extraction needs to be remedied, and action needs to be taken if thresholds are exceeded" (Nelson 2013).

Storage and disposal of massive volumes of produced water, waste water and the mountains of toxic salts brought to the surface are all serious problems for which the industry should be required to prove safe disposal solutions.

**(c) any implications for local and regional development, investment and jobs**

While this industry claims to create many jobs, ABS data shows that the gas industry is a relatively small employer. ABS figures for August 2013 show that the entire oil and gas industry, of which CSG is a part, employed 20,700 people, 0.2% of the workforce. By way of context Bunnings, a retail hardware enterprise, employs 33,000 people (Grudnoff 2014:27). Further the industry claimed to have been responsible for an estimated 100,000 Australian jobs in 2013, however the ABS showed that only 9,372 jobs had been created in the oil and gas industry that year (Grudnoff 2014:28). The gas industry is spending on investment projects, most of which are LNG export facilities. Such projects generate short term jobs during the construction phase. These workers need to be "poached" from other industries, and the effect can be to either drive up wage costs of some industries, or force the shutdown of enterprises that cannot secure strategic staff (Grudnoff 2014:36-37). Recent media on the boom/bust nature of CSG has shown local businesses and investors in Chinchilla, Queensland experiencing losses as the temporary workforce moves on.

(4) **THE ABILITY OF POTENTIAL ONSHORE UNCONVENTIONAL GAS RESOURCES CONTRIBUTING TO THE STATE'S OVERALL ENERGY SOURCES INCLUDING –**

**(a) an ability to provide a competitive source of energy and non- energy inputs for Victorian industry and (b) an affordable energy source for domestic consumers;**

Australia's eastern gas market becomes linked to the world market with LNG being exported from Gladstone. The world price is considerably higher than the current eastern market price paid by Australian consumers and companies, so local price will rise to world export parity price, i.e. the world LNG price, minus the cost of transporting the gas from Australia to foreign markets (Gudnoff 2014:11).

The prospect of higher prices has made the gas industry eager to increase its supply, as gas will be more profitable. The western, northern and eastern gas markets function separately, the western market is linked to the world gas price, produces 59% of Australia's natural gas, and exports significant quantities of LNG.

The WA government has a policy setting aside a portion of gas for domestic use, and the peak industry body "Manufacturing Australia" has called on the government to introduce a similar gas reserve policy for the eastern market in view of world prices. However the gas industry is resisting those calls, claiming that such a policy will prevent investment in new gas supply (Grudnoff 2014:12-17). Industrial and domestic users can expect to pay higher prices for gas.

This demonstrates the industry's business model is antipathetic to the intended host community.

**(c) carbon dioxide emissions from these sources**

Unconventional gas is sometimes referred to as "a bridge to clean energy" but this is refuted because of the high greenhouse gas factor of methane (87 times greater) compared with carbon dioxide over the first twenty years of its presence in the atmosphere, averaging out to a factor of 20 over one hundred years. Carbon dioxide, mainly produced from the burning of fossil fuels, is the dominant contributor to human induced climate change, but methane has stronger warming effects. Moving to renewable energy sources rather than adopting the unnecessary unconventional gas industry would reduce emissions and address the main issue, global warming.

Additional global warming is inevitable and will require adaptation measures. Indeed adaptation is needed now in response to climate change that has occurred already. The greater the emission burden in the next few decades, the stronger the adaptation measures that will be needed in future. There are limits to the adaptive capacities of both ecosystems and human societies. Thus the decisions made today on emissions will affect not only the

future requirements for, and costs of adaptation measures, but also their feasibility. (AAS2015:31)

**(5) THE RESOURCE KNOWLEDGE REQUIREMENTS AND POLICY AND REGULATORY SAFEGUARDS THAT WOULD BE NECESSARY TO ENABLE EXPLORATION AND DEVELOPMENT OF ONSHORE UNCONVENTIONAL GAS RESOURCES INCLUDING**

**(a) FURTHER SCIENTIFIC WORK TO INFORM THE EFFECTIVE REGULATION OF AN ONSHORE UNCONVENTIONAL GAS INDUSTRY, INCLUDING THE ROLE OF INDUSTRY AND GOVERNMENT, PARTICULARLY IN RELATION TO RIGOROUS MONITORING AND ENFORCEMENT, AND THE EFFECTIVENESS OF IMPACT MITIGATION RESPONSES;**

Mining is dangerous enough, and although there have been advances since the days when the demise of a canary in a cage warned workers of gases in mines, technology cannot solve all the inherent issues. Moreso in unconventional mining, and, as in other life experiences, discretion is the better part of valour. "The precautionary principle asserts that the burden of proof for potentially harmful actions by industry or government rests on the assurance of safety and that when there are threats of serious damage, scientific uncertainty must be resolved in favour of prevention". (Goldstein 2001).

An emerging trend is growing evidence that regulations are simply not capable of preventing harm. This is both because the number of wells, and their attendant infrastructure keeps increasing and, more importantly, because some of fracking's many component parts, which include the subterranean geological landscape itself, are simply not controllable (CHPNY:2).

The parent fracking industry in the USA was, however, relieved of normal federal regulatory compliance when Dick Cheney, previously CEO of Halliburton (which company was the first to conduct hydraulic fracturing operations in 1949, invented the new horizontal drilling technology around 2002, and owns the patent on fracking fluids), became Vice President of the USA under President George Bush. In the USA the phrase "Halliburton Loophole" is in common parlance, and refers to exemptions from "key provisions of all of the landmark environmental laws including the Clean Air Act, the Safe Drinking Water Act, the Clean Water Act and laws regulating hazardous wastes" (Nolon and Gavin 2013) ushered through Congress under Cheney. The enabling legislation, the 2005 Energy Policy Act, significantly reduced federal oversight of drilling and fracking operations. Such relations between industry and government conflict with principles of good governance. This conflict is further seen in the hampering of the work of the EPA, a statutory organisation, when it tried to investigate damaging effects of the industry on various communities' water supplies. (Food and Water Watch 2014:5) Such behaviour has corrupted public trust in the very institution of government, betrayed the hopes inherent in the notion of democracy, and the resultant profit model has been a driver of the global expansion of 'fracking'.

**(b) PERFORMANCE STANDARDS FOR MANAGING ENVIRONMENTAL AND HEALTH RISKS, INCLUDING WATER QUALITY, AIR QUALITY, CHEMICAL USE, WASTE DISPOSAL, LAND CONTAMINATION AND GEOTECHNICAL STABILITY;**

"Methane migration is a critical part of the discussions of underground contamination risks from drilling and hydraulic fracturing because it demonstrates that a pathway exists for contaminants to move through the substrata to the surface or into water supplies. In many of the cases described in ProPublica's articles, methane – which was proved to be thermogenic and not from biological decay – is believed to have moved from thousands of feet underground, or travelled several miles laterally, sometimes from the same layer of gas being exploited for energy.

If methane can move, it indicates the ability of other substances to move as well. Many of the methane migration cases have been traced to flaws in the cementing and casing of the wells. Others may have migrated directly through underground faults and fissures.

Scientists consistently make two points :-

1. The pressure of hydraulic fracking inside a well structure exerts great force that can exploit cementing problems. In other words a crack in the cement or casing might be fine until the pressure of hydraulic fracturing forces substances through it.
2. It doesn't matter whether contaminants reach aquifers through a spider web of geologic cracks created by hydraulic fracking, or in the spaces alongside the well bore that was pushed through the earth. Contaminants are reaching water supplies as a result of the processes and pressures being exerted underground". (Lustgarten 2010)

Interestingly, in this regard in America two things are clear and link the growth of this industry to the "Halliburton loophole". Was that loophole necessary because these basic aspects of the work cannot, in fact, be regulated? Was it therefore necessary to get powerful industry insiders elected to ensure that the industry could develop for its own financial benefit at the environmental and health expense of the public? A similar outcome is seen now in Queensland. Will we see the same in Victoria?

"The missing federal regulatory framework in the USA enables the following practices :-

1. Hydraulic fracturing is the only aspect of the complicated drilling process where basic standards for safe operations are not set by the federal government.
2. If fracturing were regulated - for instance under the Safe Drinking Water Act, the federal law that regulates every other type of underground chemical injection – the law would likely require the sort of well integrity tests and localized pre-drilling geologic assessment analysis to ensure that underground faults and fractures could not reach water supplies. It would also likely require that well casing and cementing be solid enough to withstand the pressures exerted by the fracking process, and thus

> prevent the well from leaking methane, or chemicals, or anything else". (Lustgarten 2010)

Again it can be seen that the precautionary principle should be followed, and that many experiences in the USA of largely unregulated practice have led to serious issues. While one can understand the industry being keen to take advantage, the role of government is to ensure the community and the environment is not sacrificed on its behalf.

**Water Issues**

In regard to risk and regulation of the amount of water used for drilling and/or fracking, source of water extraction, chemicals added to water, treatment and storage of waste and processed water, likely path of travel towards other bodies of groundwater of any processed water re-introduced into underground storage, are Catchment Management Authorities where unconventional mining exploration licences have been, or may be, issued, fully appraised of the issues? What authority do they have in regard to the issuing of licences?

The most useful performance standard to manage the serious risks – water, chemicals, waste products, air pollution, transportation issues – all of which are inherent to this industry would be to cut right back the legacy of government support to fossil fuel generation. Permits and subsidies to this industry hinder the development of clean and sustainable energy systems.

Undertaking difficult reform and transformational change has led to implementation of policy change in a number of countries, reforming fossil fuel subsidies or implementing renewable energy subsidies, resulting in benefits for renewable energy as well as the economy and society more broadly. (Bridle and Kitson 2014:19)

**CONCLUSION**

We have an uncertain future ahead of us in regard to global warming and associated climate change, growing demands on the planet's limited resources, the impact of free trade agreements and corporate power, shifting global power relations.

Traditional institutions of governance are challenged by all of these factors. It behoves us to tread carefully into this future.

Much of the literature on unconventional mining is concerned about the impact of 'cumulative impacts', some of which I have briefly described above. Commissioner Joseph J. Martens' conclusion to the recently released study by the New York Department of Environmental Conservation (NYSDEC 2015:43) pursuant to the State Environmental Quality Review Act is that

“These findings are the culmination of a nearly seven-year process to fully and exhaustively evaluate the environmental impacts of this activity, determine the measures and controls that would minimize such impacts, review and understand the science and experiences observed in other parts of the country, and understand the risks and uncertainties arising from the activity.

“In the end there are no feasible or prudent alternatives that would adequately avoid or minimize adverse environmental impacts and that address the scientific uncertainties and risks to public health from this activity. The Department’s chosen alternative to prohibit high-volume hydraulic fracturing is the best alternative based on the balance between protection of the environment and public health and economic and social considerations”.

Likewise in Australia, Gudnoff (2014:50) concludes that the expansion of CSG is likely to bring limited economic benefits and to come with large environmental and health risks. The industry should be subject to further scrutiny by governments and policy makers before any expansion is considered. The benefits do not seem to justify the risks.

The threat of global warming is so great that addressing it should be the organising principle for decision making for all responsible people at all levels of society. “Continued emission of greenhouses gases will cause further warming and long-lasting changes in all components of the climate system, increasing the likelihood of severe, pervasive and irreversible impacts for people and ecosystems. Limiting climate change would require substantial and sustained reductions in greenhouse gas emissions which, together with adaptation, can limit climate change risks”. (IPCC 2014:8) It seems that the most practical and useful policy approach to adopt is to limit, reduce and replace greenhouse gas emitting sources of energy, and support the development of renewable energy to the greatest extent possible. “Effective decision-making to limit climate change and its effects can be informed by a wide range of analytical approaches for evaluating expected risks and benefits, recognizing the importance of governance, ethical dimensions, equity, value judgements economic assessments and diverse perceptions and responses to risk and uncertainty” (IPCC 2014:17). This, together with careful conservation of water and protection and enhancement of the natural world, is what will fulfil our responsibility to give the next generations the greatest chance of a healthy environment.

Choosing to take the responsible step of preventing Unconventional Gas exploration and mining in Victoria would be a step towards delaying global warming at this critical time.

To echo Dr Patzert’s words, let’s listen to the scientists, show us we voted wisely, let’s fight our carbon addiction, let’s put humanity into this game.

I would appreciate the opportunity to be heard by the Environment and Planning Committee.

**REFERENCES**

AAS 2015 "The Science of Climate Change: Questions and Answers" Australian Academy of Science, Canberra 2015 www.science.org.au/climatechange

ACOLA "Engineering energy: Unconventional Gas Production" June 2013 www.acola.org.au

Armstrong, Fiona, Haworth, Elizabeth, Tait, Peter, and Barker, Harriet. Health and Energy Policy, *Briefing Paper, February 2013,* Climate Health Alliance, national Rural Health Alliance Inc, Australian Healthcare and Hospitals Association, Public Health Association Australia, NCCARF National Climate Change Adaptation Research Facility – Adaptation Research Network:Human Health www.caha.org.au/wp-content/uploads/2010/01/Health-and-Energy-Policy-Roundtable-Briefing-Paper_120213_final.pdf

Bridle, Richard and Kitson, Lucie. "The Impact of Fossil-Fuel Subsidies on Renewable Electricity Generation". GSI Report December 2014. International Institution for Sustainable Development, www.iisd.org

Carrington, Damian "Fossil fuels subsidised by $10m a minute, says IMF", www.theguardian.com Monday 18 May 2015

Coady, David, Parry, Ian, Sears, Louis, and Shang, Baoping "How Large are Global Energy Subsidies?" International Monetary Fund, WP/15/105 www.imf.org/external/pubs/cat/longres.aspx?sk+42940.0

CHPNY Concerned Health Professionals of New York *"Compendium of Scientific, Medical and Media Findings Demonstrating Risks and Harms of Fracking"* www.concernedhealthny.org

Deyette, Jeff, Clemmer, Steven et. al. "The Natural Gas Gamble: *A Risky Bet on America's Clean Energy Future,* March 2015 www.ucsusa.org/the_natural_gas_gamble/

Food and Water Watch "The Urgent Case for a Ban on Fracking" 2014 www.foodandwaterwatch.org

Goldstein, Bernard M., MD, *"The Precautionary Principle also applies to Public Health Actions"* Am. J. Public Health, 2001, September 91(9):1358-1361 http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1446778/

Gudnoff, Matt "Fracking the Future. *Busting industry myths about coal seam gas.* Institute Paper No. 16, The Australia Institute, March 2014

Haluszczak, L.O., A.W. Rose, and L.R. Kump 2012. Geochemical evaluation of flowback brine from Marcellus gas wells in Pennsylvania, USA. *Applied Geochemisry 28:55-61. Online at www.sciencedirect.com/science/article/pii/SO883292712002752.pdf* (quoted in Deyette, Jeff, Clemmer, Steven et. al. "The Natural Gas Gamble: *A Risky Bet on America's Clean Energy Future,* March 2015 www.ucsusa.org/the_natural_gas_gamble/)

Mulvey, Kathy, Shulman, Seth et. al. "The Climate Deception Dossiers; *Internal FossilFuel Industry Memos Reveal Decades of Corporate Disinformation* July 2015 www.ucsusa.org/climate_deception_dossiers

IPCC – Climate Change 2013*: The Physical Science Basis, contribution of working group 1 to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (Stocker, T.F, D.Qin, G.-K. Plattner, M.Tignor, S.K.Allen, J.Boschung, A.Nauels, Y.Xia, V.Bex and P.M.Midgley (eds.) Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535pp.

IPCC 2014 – Climate Change 2014 Synthesis Report, Summary for Policymakers www.ipcc.ch/pdf/asessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf

Kang, Kanno, Reid, Zhang, Mauzerall, Celia, Chen & Onstott, "Direct measurements of methane emissions from abandoned oil and gas wells in Pennsylvania", ed. Stephen W. Pacala, Princeton University, Princeton NJ 2014 www.pnas.org/cgi/doi/10.1073/pnas.1408315111

Lustgarten, Abrahm. "Why Gas Leaks Matter in the Hydraulic Fracking Debate", ProPublica Aug 2 2010, www.propublica.org/series/fracking

McCarron, Geralyn. "Symptamatology of a gas field, An independent healthy survey in the Tara rural residential estates and environs", April 2013 geralynmcc@iinet.net.au

McKenzie, Guo, Wittner, Savitz, Newman and Adgate, 2014, National Institute of Environmental health Sciences, Environmental Health Perspectives, http://www.ehponline.org

McCoy, Dr David & Saunders, Dr Patrick. "Health and Fracking: The Impacts and Opportunity Costs" MedAct, www.medact.org 2015

Mulvey, Kathy, Shulman, Seth et al. "The Climate Deception Dossiers; *Internal FossilFuel Industry Memos Reveal Decades of Corporate Disinformation* July 2015 www.ucsusa.org/climate_deception_dossiers

Myhre, Gunnar et al. "Anthropogenic and Natural Radiative Forcing" in *Climate Change 2013: The Physical Science Basis, contribution of Working Group 1 to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (Stocker, T.F, D.Qin, G.-K. Plattner, M.Tignor, S.K.Allen, J.Boschung, A.Nauels, Y.Xia, V.Bex and P.M.Midgley (eds.) Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535pp. (Quoted in "the Urgent Case for a Ban on Fracking", Food and Water Watch, September 2014:18). www.foodandwaterwatch.org

Nelson, Rebecca, presentation at EDO 3/7/2013, http://waterinthewest.stanford.edu/programs/groundwater/comparative-law-and-policy

Nolon, J.R. and S.E. Gavin. "Hydrofracking: State pre-emption, local power, and cooperative governance". *Case Western Reserve Law Review.* Vol. 63, Iss.4. April 29, 2013 at 1001 to 1013: Mall, Amy and Dianne Donnelly. Natural Resources Defense Council. "Petition for Rulemaking Pursuant to Section 6974(a) of the Resource Conservation and Recovery Act". September 8, 2010 at 8 to 9. Quoted in Food & Water Watch "The Urgent Case for a Ban on Fracking"(2014:3) www.foodandwaterwatch.org

NYSDEC 2015 "Final Supplemental Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program". *Regulatory Program for Horizontal Drilling and High-Volume Hydraulic Fracturing to Develop the Marcellus Shale and Other Low-Permeability Gas Reservoirs.* Findings Statement. June 2015 www.dec.ny.gov

NYSDOH 2014 "A Public Health Review of High Volume Hydraulic Fracturing for Shale Gas Development" December 2014

Patzert, Dr William 2015, NASA Global Climate Change, Vital Signs of the Planet www.climate.nasa.gov/400ppmquotes/

Propublica www.propublica.org/series/fracking

Rowan E.L., M.A. Engle, C.S. Kirby, and T.F. Kraemer. 2011. *Radium content of oil- and gas-field produced waters in the northern Appalachian basin (USA): Summary and discussion of data.* U.S. Geological Survey scientific investigations report 2011-5135. Reston, VA: U.S. Geological Survey. Online at *http://pubs.usgs.gov/sir/2011/5135/pdf/sir2011-5135.pdf* (quoted in Deyette, Jeff, Clemmer, Steven et. al. "The Natural Gas Gamble: *A Risky Bet on America's Clean Energy Future,* March 2015 www.ucsusa.org/the_natural_gas_gamble/)

Steffen, Will "Thirsty country, climate change and drought in Australia", Climate Council of Australia 2015.

Rice, Doyle, USA Today "*Hurricane Sandy, drought cost US $100 billion"* January 25, 2013 www.usatoday.com

Taylor, Maria "Global Warming and Climate Change, what Australia knew and buried…then framed a new reality for the public" ANU Press, 2014 http://press.anu.edu.au

Twomey, David "UN warns gap narrowing for averting climate disaster", 9 July 2015 www.econews.com.au