



The Wilderness Society Newcastle
90 Hunter Street
Newcastle, NSW 2300
7th February 2013

Dear Sir/Madam,

Submission to the Senate Committee Inquiry into the Impacts of Air Quality on Health

The Wilderness Society Newcastle welcomes the opportunity to comment on the impacts of air quality on health. Environmental and human health are closely related with many of the causes of environmental damage having equally severe impacts on local residents both physically and mentally.

In particular we would like to raise our concerns on the impacts of coal and coal seam gas mining and then recommend improvements to the planning process to mitigate these impacts. This will include our experience in campaigning to stop the damage of open cut-coal and coal seam gas mining on our environmental areas, water bodies and climate and knowledge of:

- a) Particulate matter, its sources and effects
- b) Those populations most at risk and the causes that put those populations at risk
- c) The standards, monitoring and regulation of air quality at all levels of government;

Sincerely,

Prue Bodsworth and Naomi Hogan

Of The Wilderness Society Newcastle

1. Coal Seam Gas and Air Quality

Term of reference (a): Particulate matter, its sources and effects

The potential for impacts on human health from the coal seam gas extraction and delivery system are many. In addition to land and water contamination issues, at each stage of production and delivery, tons of toxic volatile compounds, including benzene, toluene, ethylbenzene, xylene, etc., and fugitive natural gas (methane), escape and mix with nitrogen oxides from the exhaust of diesel-driven, mobile and stationary equipment to produce ground-level ozone¹. The coal seam gas flaring process can produce many hazardous chemicals including polycyclic aromatic hydrocarbons (PAHs, including naphthalene), benzene, toluene, xylenes, ethyl benzene, formaldehyde, acrolein, propylene, acetaldehyde and hexane, as stated by the Colorado School of Public Health².

Gas field produced ozone has created a serious air pollution problem and causes irreversible damage to the lungs. The health risks inherent in the current coal seam gas extraction process are unacceptable.

The coal seam gas industry has been operating in the United States of America since the early 1980's. During this time members of the 'oil and gas communities' have reported a range of illnesses caused by the inhalation and ingestion of toxic chemicals that are found to be naturally occurring in the oil and gas exploration process³. A number of these personal accounts are described in *Collateral Damage: A Chronicle of Lives devastated by Gas and Oil Development*, and were presented at the Western Colorado Congress in Denver in March, 2006. Members of the communities in Rifle and Silt, Colorado gave personal accounts of the health impacts that they experienced since the coal seam gas industry had constructed wells in their towns.

Whilst the causal link between the human health impact and the coal seam gas process is currently being investigated by a number of law firms in the USA⁴, it is imperative that the Australian government is pro-active with regards to protecting the health of residents who have coal seam gas wells, pipelines, compressor stations and coal seam gas water evaporation ponds near to their homes.

Coal seam gas water evaporation ponds have also been known to contain a number of naturally occurring toxic chemicals. Produced water from coal bed methane wells are saltier

¹ Colburn, T, 2010, *The Endocrine Disruptor Exchange*
<http://www.endocrinedisruption.com/chemicals.introduction.php>, accessed 23 August, 2010

² Witter et al, 2008, *White Paper: The Potential Exposure-Related Human Health Effects of Oil and Gas Development*, Colorado School of Public Health

³ Meixsell, T, 2010, *Collateral Damage: A Chronicle of Lives devastated by Gas and Oil Development and the Valient Grassroots Fight to Effect Political and Legislative Change*, Create Space, CA

⁴ Lofholm, N, 2005, *Breached well fuels feud with gas firm, Woman had tumor after blowup*, The Denver Post

the deeper the coal seam and may also contain nitrate, nitrite, chlorides, other salts, benzene, toluene, ethylbenzene, other minerals, metals, and high levels of total dissolved solids. These ponds release toxic gases and there have been cases recorded in New Mexico and Colorado where people have passed out from inhalation of these gases. This is not only a concern for nearby residents but also for staff of the coal seam gas companies.

The following substances were detected in six drilling reserve pits in the San Juan Basin of northwestern New Mexico and the Permian Basin of southeast New Mexico. An industry committee comprised of 19 oil and gas companies that operate in New Mexico sponsored a sampling and analysis program (SAP) of pit solids. The SAP was completed by a third party consultant and analytical laboratory, and the findings are set out below⁵:

1,2,4-Trimethylbenzene	Iron	Uranium
1,3,5-Trimethylbenzene	Isopropylbenzene	Zinc
1-Methylnaphthalene	Lead	Oil and Grease
2-Butanone	m+p-Xylene	Radium 226
2-Methylnaphthalene	Manganese	Radium 228
3+4 Methylphenol	Mercury	Chloride
Acetone	Methylene chloride	Sulfate
Arsenic	Naphthalene	
Barium	N-Butylbenzene	
Benzene	N-Propylbenzene	
Benzo(a)pyrene	O-xylene	Substances eliminated
Cadmium	Pentachlorophenol	<i>Dibromofluoromethane</i>
Carbon disulfide	Phenol	<i>2-Fluorophenol</i>
Chromium	P-Isopropyltoluene	<i>2,3,4-Trifluorotoluene</i>
Copper	Sec-butylbenzene	<i>2,4,6-Tribromophenol</i>
Cyanide, total	Selenium	<i>2-Fluorobiphenyl</i>
Diesel range organics	Silver	<i>4-Bromofluorobenzene</i>
Ethylbenzene	Tert-butylbenzene	<i>Decachlorobiphenyl</i>
Fluoride	Tetrachloroethene	<i>O-Terphenyl</i>
Gasoline range organics	Toluene	<i>Tetrachloro-m-xylene</i>

The health impacts of these chemicals are listed in the table below:

⁵ Colburn, T, 2009, Letter to the Colorado Oil and Gas Conservation Commission, Comments for Rule Making, The Endocrine Disruptor Exchange, Colorado

Percentage	Number	Effect
100%	42	gastrointestinal and liver toxicants
95%	40	respiratory toxicants
90%	38	neurotoxicants
88%	37	skin and sensory organ toxicants
79%	33	cardiovascular and blood toxicants
79%	33	kidney toxicants
69%	29	developmental toxicants
69%	29	reproductive toxicants
60%	25	result in other disorders
57%	24	immunotoxicants
57%	24	wildlife toxicants
50%	21	endocrine disruptors
48%	20	carcinogens
31%	13	mutagens

The above table shows that of all of the 42 chemicals found in the coal seam gas water, all of them were found to be gastrointestinal and liver toxicants. 20 of the 42 chemicals were carcinogenic.

Term of reference (b): Those populations most at risk and the causes that put those populations at risk

The Wilderness Society Newcastle are deeply concerned that there is potential any for residents who live in proximity to gas wells to be exposed to gases released from this process, and therefore be exposed to health risks associated with the inhalation of Volatile Organic Compounds. The Santos Ltd Environmental Impact Statement (EIS) 2009, states that during upset conditions, the coal seam gas will be flared, however there was no modelling conducted regarding the gas plumes. This is concerning because gas flaring is known to produce airborne carcinogens such as BTEX chemicals.

We are also concerned regarding the high rate of leaking coal seam gas wells as described in the report 'Leakage testing of coal seam gas wells in the Tara 'rural residential estates', which found 26 out of the 58 gas wells were leaking. Fugitive emissions from coal seam gas wells comprise of methane and other hydrocarbons (ethane, propane, butane), hydrogen sulfide (H₂S) and water vapour and some gas wells produce a condensate that can contain complex hydrocarbons and aromatic hydrocarbons such as benzene, toluene, ethyl benzene and xylene (BTEX chemicals). Whilst ambient air showed low traces of gases, there are more gas wells planned for the area and increasing the concentration of wells and compressor stations is likely to increase ambient air concentrations of gases.

A cluster of ill health that may be related to CSG extraction has developed in the Tara Estate, Western Downs, Queensland. Residents living in rural estates in close proximity to hundreds of CSG wells are experiencing a variety of symptoms including daily headaches, breathing

difficulty, rashes and skin irritation after bathing, nose and ear bleeds, metallic taste, eye irritation, dizziness, nausea and vomiting. These symptoms are not specific if taken individually, but together they form a pattern of health complaints which display similarity with patterns reported in established gas fields in Canada and the US.

It has been documented by the recent Al Jazeera program 'Risky Business', that families living in the Tara Estate can no longer sell their properties and start over. These families cannot afford to pick up and leave and are now suffering and experiencing symptoms that have been associated with chemicals poisoning from chemicals known to occur in the coal seam gas extraction process. While we need further research regarding these health impacts, the existing evidence should indicate that there are already serious doubts about the safety of coal seam gas extraction. Failure to act on the part of your Government and Department increases the risk to these communities. This is the same recommendation that has been made by South West Sydney Local Health District for the proposed wells in Cambelltown near Sydney.

It is a general concern that those from low socioeconomic backgrounds are the people that have the least options to move away from nearby gasfields. Also worthy of note is the threatened species in the vicinity of a gasfield with a limited range due to other habitat stresses will also bear the brunt of health impacts from air quality decline.

Term of reference (c): The standards, monitoring and regulation of air quality at all levels of government

Lack of adequate baseline and ongoing environmental monitoring of air and water have made investigation of illness clusters such as this extremely difficult. The organisation Doctors for the Environment have stated that 'NSW still has the chance to avoid some of the problems now being seen to arise in Queensland, by adequate regulation and exercise of the precautionary principle where there are significant unknowns in the risk to human health'.

There are major flaws in the State Government planning process with regards to preventing health impacts on communities from coal seam gas mining. Firstly, the planning process for coal seam gas exploration is a Review of Environmental Factors (REFs). These REFs are not open to the public are not submitted to the Department of Health for input and do not address the impacts of air pollution on human health. This is concerning as the exploration for coal seam gas is a very similar to process to production and results in air pollution. There is also no baseline study of residents, no recommended standards for air pollution and no monitoring. Given that there has been no comprehensive investigation by the NSW Health Department into coal seam gas, allowing coal seam gas to occur within built up residential areas such as Fullerton Cove (where 86 families live within a 2km radius of the proposed drilling) that may not be zoned 'Residential', is an extremely high risk activity.

Air monitoring is essential for any coal seam gas project however has been ignored by the State Governments. Firstly, there must be a comprehensive study on health impacts of coal seam gas so that an appropriate air quality monitoring regime and air quality standards can be developed. This is a serious oversight of the government that this industry has been able to proceed without this analysis.

In addition to the health study, prior to any drilling taking in Australia a health study of residents must be conducted. This is the minimum protection residents should be entitled to ensure that any potential health issues resulting from the drilling are identifiable. This baseline testing will also help to avoid the issues faced by communities in Queensland.

2. Coal and Air Quality

This section of the submission mentions a range of well documented health, especially respiratory, impacts of coal dust on those who work in the industry or are exposed to coal dust or coal burning emissions through their lives.

Term of reference (a): Particulate matter, its sources and effects

The health impacts of exposure to particle pollution include increased rates of respiratory and cardiovascular hospitalisation, lung cancer and mortality, systemic inflammation and oxidative stress, enhanced formation of plaque and progression of atherosclerosis, changes in the regulation of the autonomic nervous system including heart rate variability, increased blood coagulability and the risk of thrombosis. Particle pollution exacerbates asthma, accelerates and exacerbates chronic obstructive pulmonary disease and decreases lung development and function. (Kolbe, T. & Gilchrist, K., 2011, 'Particulate matter air pollution in a NSW regional centre: A review of the literature and opportunities for action', Centre for Inland Health, Charles Sturt University, Wagga Wagga)

Please see the attached overview provided in the Medical Journal of Australia. Link here: http://www.fof.org.au/uploads/media/MJA_Coal.pdf

This paper brings forward clear examples of the impacts of coal mining and burning. This is a short list of the most relevant points for this inquiry:

1. Dust exposure in 33 longwall coalmines in New South Wales exceeded the Australian National Standard of 3 mg/m³ in 6.9% of measurements, and the risk of pneumoconiosis and lung fibrosis was estimated to be about 2% after a 40-year working life. (Kizil GV, Donoghue AM. Coal dust in the longwall mines of New South Wales: a respiratory risk assessment. *Occup Med (Lond)* 2002; 52: 137-149).
2. According to the National Institute for Occupational Safety and Health, pneumoconiosis was responsible for about 10 000 deaths in the US in the 10 years to

November 2009. (Lockwood AH, Welker-Hood K, Rauch M, Gottlieb B. Coal's assault on human health: a report from Physicians for Social Responsibility. Washington DC: PSR, 2009. <http://www.psr.org/assets/pdfs/psr-coal-fullreport.pdf> (accessed Jun 2011)).

3. Medical practitioners in coalmining areas have reported that increases in asthma, stress and mental ill health have become more common. (Fowler A. A dirty business. Four Corners [television program]. Sydney: ABC, 2010. <http://www.abc.net.au/4corners/content/2010/s2870687.htm> (accessed Jun 2011)).
4. Higginbotham and colleagues detailed the social and political consequences that result from coal mining in a region. (Higginbotham N, Freeman S, Connor L, Albrecht G. Environmental injustice and air pollution in coal affected communities, Hunter Valley Australia. *Health Place* 2010; 16: 259-266).
5. An Australian review of air pollution by Kjellstrom and colleagues summarises the effects of particle exposure on health:

These include respiratory symptoms such as cough, aggravated asthma, the development of chronic bronchitis and decreased lung function; arrhythmias, nonfatal heart attacks and premature death in people with heart or lung disease; the effects of absorption of toxic material; and allergic or hypersensitivity effects. The smallest particles, particulate matter (PM) 2.5, are the most damaging. (Australian Air Quality Group. Particles. AAQG: Armidale, 25 Apr 2010. <http://aaqg.3sc.net/air-pollution-and-health/particles> (accessed Aug 2011)).

6. Many PM 2.5 particles are produced during coal-fired power generation. Specific data in Australia are lacking; however, in the US, the Physicians for Social Responsibility examined the evidence for health damage caused by coal. The risk of premature death for people living within 30 miles of coal-burning power plants has been quoted to be three to four times that of people living at a distance. (Epstein PR, Reinhart N. Testimony for the Kentucky General Assembly, House of Representatives Committee on Health and Welfare. London, Ky: Kentuckians for the Commonwealth, 2010. <http://www.kftc.org/blog/linkedddocuments/documents/Epstein%20Testimony.doc> (accessed Jun 2011)).
7. Other toxic elements released with coal combustion include arsenic, mercury, fluorine, cadmium, lead, selenium and zinc. Mercury is of greatest concern. Over a third of all mercury emissions attributable to human activity come from coal-fired power stations. (Lockwood AH, Welker-Hood K, Rauch M, Gottlieb B. Coal's assault on human health: a report from Physicians for Social Responsibility. Washington DC: PSR, 2009. <http://www.psr.org/assets/pdfs/psr-coal-fullreport.pdf> (accessed Jun 2011)).

Further evidence of the impacts of coal particles travelling through air was presented to a Newcastle audience on August 21 2012 by Peter Orris MD, MPH, FACP, FACOEM, Professor and Director of the Occupational Health Services Institute University of Illinois at Chicago School of Public Health.

Dr Orris' presentation put forward a number of clear points, namely:

Scientific studies have linked fine particles with a series of significant health problems. Fine particles easily reach the deepest parts of the lungs. Particulate matter causes 15,000 premature deaths every year in the US. Fine particles from diesel exhaust can cause lung cancer.

The **health effects of particulate matter** include:

Premature death, Aggravated asthma, Respiratory-related emergency room visits and hospital admissions, Acute respiratory symptoms, Chronic bronchitis, Decreased lung function (shortness of breath).

Silicosis is a major health risk in people exposed to coal particulate matter in high doses over long periods.

Coal fired power stations are a major source of environmental **Mercury** from human activity. Approximately 85% of this mercury comes from combustion point sources.

Cadmium is found in coal particles and has impacts on the following:

Lungs: Bronchitis, Emphysema, conflicting data on lung cancer

Kidneys: Nephritis, Stones, Decreased Function.

Beryllium is another common element that can lead to:

Acute lung inflammation, and while high dose exposure is rare, can lead to sensitization without disease, Chronic beryllium disease, Scars (involving lung, skin, liver, spleen, kidney, lymph nodes, heart, skeletal muscle, bone, salivary glands) or lung cancer (IARC Class I).

Arsenic (also found in coal particles) impacts on peripheral neuropathy and causes cancer of the lung and skin.

Asthma is inflamed by exposure to the following element disrupted through the mining or burning of coal:

Chromium, Cobalt, Nickel, Platinum salts

The following coal associated metals are associated with **lung cancer**:

Arsenic, Beryllium, Cadmium, Chromium, Nickel, Arsenic.

Term of reference (b): Those populations most at risk and the causes that put those populations at risk

People with existing heart and lung disease, as well as the elderly and children, are particularly at risk from the impacts of coal particulate matter in the air where they live, work and go to school.

Populations at risk are not only limited to humans but include native wildlife and agricultural animals. There have been reports from farmers located near the current Boggabri mine in Northwest NSW that local bee populations have died in recent years, concurrent with the coal mine development. As a result, the farmers in this region have had to undertake labour intensive hand pollination of particular vegetable and fruit produce.

It could be confidently said that any animals with similar respiratory systems to humans exposed to particulate pollution would have their health affected in a similar fashion and could suffer from the complaints listed above. More research is needed in this area, particularly for species already under threat or where the habitat is limited to areas that are going to be impacted heavily by surrounding coal mining expansions.

Term of reference (c): The standards, monitoring and regulation of air quality at all levels of government

Health impacts assessments must be carried out prior to the development of coal mining projects to ensure that the most accurate baseline health data.

Monitoring is needed in sites heavily impacted by coal mining, reference sites and sites that are likely to become impacted if planned mines go ahead. Testing should not only include Pm 10 PM2.5 and PM 1 analysis, but also chemical analysis of what the particles consist of and their relative risk to health.

3. Overall Recommendations

- A moratorium on all coal and coal seam gas drilling until a comprehensive study into the human health impacts of coal seam gas is conducted as recommended by the South Western Sydney Local Health District.
- All Review of Environmental Factors (NSW) are referred to the relevant Local Health Districts for assessment and available to the public for comment.
- Baseline monitoring of all residents located within a 2km buffer zone of coal and coal seam gas (and further if deemed appropriate due to climate/prevaling wind variables).
- The development of air pollution standards specific to coal and coal seam gas.
- Monitoring of coal and coal seam gas air pollutants at all coal mines and coal seam gas fields and associated infrastructure such as compressor stations.

- Greater funding available for community wide Health Impact Assessments.
- Chemical analysis of air particulate matter to ascertain the
- Exceedences of PM levels should be treated with appropriate concern and action. Accountability must be sought and further approvals and expansions of projects known to worsen air quality in areas already under pressure by exceedences must be put on hold until the problem is mitigated or rejected on the basis of risks and impacts of community health costs.
- A complete review of NEPM standards to ensure they are at least as good as the World Health Organisation standards is required.
- Independence from mining companies in collecting information from planning assessments.
- We recommend the panel seeks out information from Dr Benjamin Ewald of the University of Newcastle and a member of Doctors for the Environment. Dr Ewald has recently undertaken analysis of the air quality monitoring in Newcastle and has a detailed knowledge of the extent and limitations to current air quality monitoring and health impacts in Australia, and could offer useful insights for the inquiry.