Submission No 145

INQUIRY INTO COAL SEAM GAS

Name: Name suppressed

Date received: 1/09/2011

General Purpose Standing Committee No 5
Legislative Council Inquiry – Coal Seam Gas
Parliament of New South Wales
Sydney NSW 2001

September 1, 2011.

Dear General Purpose Standing Committee,

Please find attached my submission to the Legislative Council Inquiry into Coal Seam Gas, which has been prepared according to your terms of reference.

My submission focuses on the issue of the management of Coal Seam Gas Produce Water. This is not only with regard to grave concerns for Public Health, but also witl regard to serious concerns about the integrity and quality of water in our streams, river and dams which provide drinking water for towns and cities, but also for lakes an wetlands and the preservation of their biodiversity. If this issue of Coal Seam Ga Produced Water is not managed carefully, and regulated and enforced strictly, then ou water integrity, food purity and hence public health will be under serious threat.

My submission focuses on the naturally occurring hazardous substances present in Coa Seam Gas Produced Water, as well as introduced hazardous substances as consequence of drilling and fracture stimulation processes. The preamble to thi submission discusses the human health impacts of a number of these substances.

The second part of this submission focuses on the analysis of naturally occurring an introduced hazardous substances of Coal Seam Produced Water from the Walloons Ga Fields Project, as listed in a QLD DERM PEN document. This is highly relevant to NSW fo numerous reasons. Firstly, the QLD DERM licenses this project to discharge this treate Coal Seam Produced Water into the Condamine River, which is a headwater of th Murray-Darling Basin. This river system provides drinking water supplies for more tha three million people, as well as irrigation and stock water to most of the fodd-producin lands of inland NSW. Secondly, it is clear from this analysis that the only requiremen from the QLD DERM is that the salts are removed from the produced water, whilst exces levels of a huge array of extremely hazardous substances remain in the water.

This should therefore alert us to the fact that we can learn from this to ensure bes practice takes place in NSW. This would require a comprehensive and independen analysis of Coal Seam Gas Produced Water initially and then continuously in a exploration and production projects. Then the requirement would need to be made fo each coal and coal seam gas company to treat the produced water to the standards a outlined in the Australian Federal Government's documents relating to water quality which are referenced in the body of this submission and also in the bibliography befor licensing for the release of this water into any waterway or for any other use, such a irrigation or stock water. Furthermore, the treated water would need to be monitore rigorously at regular intervals to ensure that water treatment standards are maintained to ensure water quality and integrity, with the view to preserving public health, foo integrity and security.

Should you have any questions regarding any of the information put forward in thi submission, please contact me.

Preamble: Coal Seam Gas Inquiry Submission

This submission focuses on the issue of Coal Seam Water that is a by-product of Coal Mining and Coal Seam Gas Mining. According to L B Clarke (1996):

> *"The disposal of co-produced water has proved to be the biggest environmental problem associated with exploitation of coal seam methane fields in the USA although the quantity and quality of the water vary enormously between coal basins. Stricter environmental regulations are making direct disposals increasingly difficult. Sometimes extensive water treatment is necessary before discharging is permitted."*
>
> (Environmental Aspects of Coal Seam Methane Extraction, with Emphasis on Water Treatment and Disposal)

Given the recent and rapid expansion of Coal Seam Gas Mining across the state of NSW, the issue of the treatment and disposal of Coal Seam Gas produced water is an urgent one that must be addressed by the regulatory authorities. This must be done with a view to preserving public health, as well as the integrity and quality of water in our river systems, so that food purity and environmental biodiversity is assured.

Coal Seam Gas produced water contains an array of naturally occurring substances, most of which are hazardous to human health, animal health and to the environment. The naturally occurring heavy metals arsenic, mercury, lead, cadmium and chromium VI are of extreme concern. Even in minute trace amounts these are very damaging to human development, health and also to the health of the environment and all forms of life.

Mercury is a neurotoxin, which can damage the brain, kidneys and the developing foetus. It can also lead to a loss of vision and hearing. It is highly toxic to aquatic life and bio accumulates in marine life.

Lead is also of extreme concern for many reasons. It causes premature births, low birth weight babies, miscarriages and stillbirths. It also results in lower IQ's, loss of memory and reduction in capacity of fine motor skills. It is linked to ADHD and autism. It can also cause anaemia and high blood pressure.

Chromium VI causes kidney & liver damage. It is a known carcinogen. It bio accumulates in marine environments and is acutely toxic to plants and animals.

Cadmium causes reproductive organ damage including prostate & testicular cancer. It also causes kidney cancer and damages the lungs. It bio accumulates in aquatic animals.

Arsenic is harmful to the developing foetus. It is carcinogenic. It causes irregularities to the heart rhythm. It decreases red blood cell production, which can lead to anemia. It causes kidney & liver damage.

Of course there are also the radioactive elements, such as uranium, which is a well known carcinogen and known to cause harm to the developing foetus, leading to an array birth defects in humans and animals.

The BTEX group - benzene, toluene, ethylbenzene and xylene - can also occur naturally in coal seam gas produced water. Benzene is a known human carcinogen, which is associated with leukemia. It has also been linked to birth defects in humans and animals. Long-term exposures of Toluene at low levels can affect the kidneys. It has also been associated with problems with speech, vision, and hearing, loss of muscle control, loss of memory and balance and reduced scores on psychological tests. Prolonged exposure to ethylbenzene is damaging to the liver and kidneys. Long-term exposure to xylenes may damage bone marrow, which causes a low blood cell count. In summary, the BTEX group includes substances that are known endocrine disrupters, which harm the developing foetus and can cause hormonal disturbances, such as pituitary, thyroid and adrenal gland conditions. They are also known carcinogens and neurotoxins, which can damage to the brain and nervous system.

Of course the coal seam gas produced water is also laden with dissolved salts, minerals and an array of other substances, which may include a variety of other hydrocarbons.

There should be a requirement across NSW for all coal seam gas mining operations to have coal seam gas water tested rigorously to list all naturally occurring contaminants, as well as any other introduced contaminants, that find their way into the coal seam water by way of drilling or fracture stimulation practices. To be precise, the testing of the coal seam produced water should include the following array of items at a minimum:

1. Electrical conductivity (µS/cm)
2. PH (ph Unit)
3. Dissolved oxygen (mg/L)

4. Temperature
5. Suspended solids (mg/L)
6. Chloride (mg/L)
7. Sulphate (mg/L)
8. Calcium (mg/L)
9. Magnesium (mg/L)
10. Sodium (mg/L)
11. # Hardness (mg/L)
12. Alkalinity (mg/L)
13. SAR (mg/L)
14. Antimony (mg/L)
15. Arsenic (mg/L)
16. Cadmium (mg/L)
17. Copper (mg/L)
18. Cyanide (mg/L)
19. Chromium VI (mg/L)
20. Fluoride (mg/L)
21. Iodine (mg/L)
22. Iodide (mg/L)
23. Iron (mg/L)
24. Lead (mg/L)
25. Mercury (mg/L)
26. Manganese (mg/L)
27. Molybdenum (mg/L)
28. Nickel (mg/L)
29. Nitrate (mg/L)
30. Nitrite (mg/L)
31. Selenium (mg/L)
32. Silver (mg/L)
33. Titanium (mg/L)
34. Zinc (mg/L)
35. Radiological Compounds (mSv/L)
36. Uranium (mSv/L)
37. Zinc (mg/L)
38. Benzene (mg/L)
39. Toluene (mg/L)
40. Ethylbenzene (mg/L)
41. Xylene (mg/L)

42. Styrene (mg/L)
43. Total Petroleum Hydrocarbons (mg/L)
44. Well Bore Cleaners: exact type/s & chemical name/s with CAS number (mg/L)
45. Corrosion Inhibitors: exact type/s & chemical name/s with CAS number (mg/L)
46. Solvents: exact type/s & chemical name/s with CAS number (mg/L)
47. Surfactants: exact type/s & chemical name/s with CAS number (mg/L)
48. Complexors: exact type/s & chemical name/s with CAS number (mg/L)
49. Clay Controllants: exact type/s & chemical name/s with CAS number (mg/L)
50. Clay Inhibitors: exact type/s & chemical name/s with CAS number (mg/L)
51. Scale Inhibitors: exact type/s & chemical name/s with CAS number (mg/L)
52. Ph Buffers: exact type/s & chemical name/s with CAS number (mg/L)
53. Biocides: exact type/s & chemical name/s with CAS number (mg/L)
54. Crosslinkers: exact type/s & chemical name/s with CAS number (mg/L)
55. Lubricants: exact type/s & chemical name/s with CAS number (mg/L)
56. Liquid Breaker Aids: exact type/s & chemical name/s with CAS number (mg/L)
57. Foamers; exact type/s & chemical name/s with CAS number (mg/L)
58. Defoamers: exact type/s & chemical name/s with CAS number (mg/L)
59. Gellants: exact type/s & chemical name/s with CAS number (mg/L)
60. Fracturing Agents: exact type/s & chemical name/s with CAS number (mg/L)
61. Viscosifiers: exact type/s & chemical name/s with CAS number (mg/L)
62. Parrafin Inhibitors: exact type/s & chemical name/s with CAS number (mg/L)
63. Friction Reducers: exact type/s & chemical name/s with CAS number (mg/L)
64. Hydrogen Sulphide Scavengers: exact type/s & chemical name/s with CAS number (mg/L)
65. Viscosity Breakers: exact type/s & chemical name/s with CAS number (mg/L)
66. Reducing Agents: exact type/s & chemical name/s with CAS number (mg/L)
67. Thinners: exact type/s & chemical name/s with CAS number (mg/L)
68. Flocculants: exact type/s & constitient/s with CAS number (mg/L)
69. Deflocculants: exact type/s & constitient/s with CAS number (mg/L)
70. Radioactive Tracers: : exact type/s & constituent/s with CAS number (mg/L)

Once tested, there should be strict conditions for the treatment of this produced water, so that it reaches the standards as outlined in the following Australian Federal Government Documents, depending upon the authorised use for the treated coal seam gas waste water:

1. *Australian Guidelines for Water Recycling: Managing Health & Environmental Risks (Phase 2) Augmentation of Drinking Water Supplies March 2008,* National Resource Management Ministerial Council, Environment Protection & Heritage Council, National Health & Medical Research Council and the

2. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality – 2000* (also known as the ANZECC Water Quality Guidelines)

It should be a requirement of any authority to operate a coal seam gas mining exploration or production licence that the coal seam gas produced water must not only be tested rigorously before any exploratory or productions operations can authorised to proceed. Once the water has been tested to reveal a comprehensive array of contaminants, the requirements should be made to have the water treated, so that it achieves the water quality standards of the higher ranges of limits of the abovementioned guidelines, rather than achieving marginal compliance. This means that the water would require higher levels of *treatment* than reverse osmosis to remove the full array of listed hazardous substances.

Furthermore, the total amount maximum amount of water, listed in megalitres per day, to be discharged should be specifically stated in the authority to operate. The exact discharge point should also be specified in the licensing conditions. The total maximum amount of water to be discharged during the life of the project should also be specified, as well as a start and finish date for the licence.

The other important issues that should be addressed under such a licence must also include the exact manner of disposal of the accumulated salts, minerals and the reportable wastes, such as heavy metals, radioactive substances and hydrocarbons – including the BTEX group.

Another crucial issue is that Coal Seam Gas Mining must be listed under the *Protection of the Environment Operations Act*, so that this industry can be given oversight by the Office of Environment and Heritage. Coal Seam Gas Mining must also be included under the *State Water Act* and *Federal Water Act*, so that the compliance with federal and state acts and guidelines regarding the integrity of river systems and waterways can be enforced.

As it currently stands, there are some requirements for the treatment of coal seam gas produced water in Queensland. By contrast, there does not seem to be any requirement for this to occur in NSW. This is evident by the fact that coal seam gas mining projects use

their so-called "salt credits" to be licensed by the state regulator to discharge untreated coal seam water into waterways. Nevertheless, the treatment required in Queensland would seem to be minimal, when one analyses the array of known contaminants that are "licensed" to be discharged into the waterways. In NSW, we must learn from what is happening in Queensland and use this knowledge to improve on industry practice and raise the standard of water treatment required, and apply this to all current and future Coal Seam Gas Projects across the state of NSW.

Accordingly, please find the following documents, in the subsequent sections of this submission, which elaborate in detail the full array of contaminant that are currently licensed to be discharged into the headwaters of the Murray Darling Basin via the Condamine River, which becomes the drinking and irrigation water supply for most of inland NSW:

1. The *Final Executive Summary*, highlights my very grave concerns for the integrity of the Murray-Darling Basin with regard to the licensed discharge of "treated" coal seam produced water into the Condamine River. The water treatment processes basically only remove the salts - leaving the dozens of hydrocarbons, heavy metals and radionuclides in the waste water effluent that is being introduced into the Murray-Darling Basin system. (It is a simple fact of chemistry that whatever is smaller than an H2O molecule will pass through the reverse osmosis membrane, meaning that the contaminant/s with smaller molecules remain in the water.)

2. A copy of the spreadsheet, which analyses this data from the QLD Government DERM PEN 100067807. This shows the total amount (in kilograms) of each substance, which is to be discharged into the Condamine River, over an 18-month period. It also shows which contaminants are at or exceeding limits, according to the WHO Safe Drinking Water Guidelines, US EPA Safe Drinking Water Guidelines Australian Safe Drinking Water Guidelines and the Australian and New Zealand Fresh Water Guidelines. Unfortunately there was no available data for many of the listed contaminants, as to "safe" limits. In those cases, it is relevant to note the total amount of these contaminants to be discharged over an eighteen month period, as many are known carcinogens, endocrine disrupters and neurotoxins.

3. A copy of relevant pages from the QLD Government DERM PEN 100067807 (the Walloons Gas Fields Petroleum Exploration Project), which states the point of discharge into the Condamine River, as well as a list of licensed contaminants and discharge amounts over an 18-month period, based on a 20 megalitre per day discharge rate.

On a final note, it must be stated that:

"Each stage in the life cycle of coal—extraction, transport, processing, and combustion—generates a waste stream and carries multiple hazards for health and the environment. These costs are external to the coal industry and are thus often considered "externalities." (page 73, Full Cost Accounting of the Life Cycle of Coal)

Given this statement, serious consideration should also be given to levying an ongoing surcharge to each and every coal mining and coal seam gas mining exploration and production project to fund the clean up of the serious damage that has already been wrought upon waterways and wetlands across the state of NSW at the hands of the coal seam gas industry. The companies who cause the damage should be held accountable to pay for the clean up and restoration bills. These costs should not be externalised back onto the taxpayers of NSW. Unless this extractive industry is carefully and scrupulously regulated, the costs to our environment, water integrity and quality, food security and purity and also human and animal health, will far exceed any benefit to NSW by way of jobs or royalties paid to the state government.

Bibliography

Australian Drinking Water Guidelines 6 (2004)
http://www.nhmrc.gov.au/publications/synopses/eh19syn.htm

Australian and New Zealand Guidelines for Fresh and Marine Water Quality – 2000 (also known as the ANZECC Water Quality Guidelines)
http://www.environment.gov.au/water/policy-programs/nwqms/

National Water Quality Management Strategy, *Australian Guidelines for Water Recycling: Managing Health & Environmental Risks (Phase 2) Augmentation of Drinking Water Supplies March 2008,* (National Resource Management Ministerial Council, Environment Protection & Heritage Council, National Health & Medical Research Council)
http://www.ephc.gov.au/sites/default/files/WQ_AGWR_GL_ADWS_Corrected_Final_%20200809.pdf

WHO (WHO Website)
http://www.who.int/water_sanitation_health/dwq/guidelines4/en/index.html

US EPA (US EPA Website)
http://water.epa.gov/drink/contaminants/index.cfm

Walloons Gas Fields Project QLD DERM PEN 100067807 (QLD DERM)
http://lockthegate.org.au/documents/doc-245-full-copy-permit-pen100067807.pdf

Natural Gas Operations from a Public Health Perspective (Theo Colborn Ph.D. TEDX, The Endocrine Disruption Exchange – September 2010)
http://www.endocrinedisruption.com/files/NaturalGasManuscriptPDF09_13_10.pdf

Summary Statement of an Analysis of the Potential Health Effects of Products and Chemicals used During Natural Gas Operations. (Theo Colborn Ph.D. TEDX, The Endocrine Disruption Exchange – September 2010)
http://www.endocrinedisruption.com/files/Multistatesummary1-27-11Final.pdf

Spreadsheet of Products, Chemicals and their Health Effects (Theo Colborn Ph.D. TEDX, The Endocrine Disruption Exchange – September 2010)
http://www.endocrinedisruption.com/chemicals.multistate.php

Potential Exposure-Related Human Health Effects of Oil & Gas Development (Dr Roxanna Witter – University of Colorado – Denver)
http://www.ccag.org.au/images/stories/pdfs/literature%20review%20witter%20et%20al%202008.pdf

Coal Bed Methane Hazards in New South Wales (C M Atkinson – January 2005 – for the Australian Gas Alliance)

Environmental Aspects of Coal Seam Methane Extraction, with Emphasis on Water Treatment and Disposal (L B Clarke – 1996 – as published in the "Transactions Institue of Mining and Metallurgy": A 105 -A113: May – August 1996)

Coal's Assault on Human Health (Alan H. Lockwood MD FAAN, Kristen Welker-Hood ScD MSN RN, Molly Rauch, MPH, Barbara Gottlieb – November 2009)
http://www.psr.org/assets/pdfs/psr-coal-fullreport.pdf

Full Cost Accounting For the Lifecycle of Coal (Paul R. Epstein, Jonathan J. Buonocore, Kevin Eckerle, Michael Hendryx, Benjamin M. Stout III,

Richard Heinberg, Richard W. Clapp, Beverly May, Nancy L. Reinhart, Melissa M. Ahern, Samir K. Doshi, and Leslie Glustrom – Annals of the New York Academy of Sciences)

http://blog.cleanenergy.org/files/2011/02/full-cost-accounting.pdf
Lead Facts Sheet (Australian Government, Department of Sustainability, Environment, Water, Population and Communities.)
http://www.environment.gov.au/atmosphere/airquality/publications/leadfs.html

Lead & Compounds of Lead (Australian Government, Department of Sustainability, Environment, Water, Population and Communities.)
http://www.environment.gov.au/atmosphere/airquality/publications/sok/lead.html

Cadmium (Australian Government, Department of Sustainability, Environment, Water, Population and Communities.)
http://www.environment.gov.au/atmosphere/airquality/publications/sok/cadmium.html

Mercury (Australian Government, Department of Sustainability, Environment, Water, Population and Communities.)
http://www.environment.gov.au/atmosphere/airquality/publications/sok/mercury.html

Nickel & Compounds (Australian Government, Department of Sustainability, Environment, Water, Population and Communities.)
http://www.environment.gov.au/atmosphere/airquality/publications/sok/nickel.html

Chromium VI (Australian Government, Department of Sustainability, Environment, Water, Population and Communities.)
http://www.environment.gov.au/atmosphere/airquality/publications/sok/chromium.html

Benzene (Australian Government, Department of Sustainability, Environment, Water, Population and Communities.)
http://www.environment.gov.au/atmosphere/airquality/publications/sok/benzene.html

Arsenic (Australian Government, Department of Sustainability, Environment, Water, Population and Communities.)
http://www.environment.gov.au/atmosphere/airquality/publications/sok/arsenic.html

Dichloromethane (Australian Government, Department of Sustainability, Environment, Water, Population and Communities.)
http://www.environment.gov.au/atmosphere/airquality/publications/sok/dichloromethane.html

Polycyclic Aromatic Hydrocarbons (Australian Government, Department of Sustainability, Environment, Water, Population and Communities.)
http://www.environment.gov.au/atmosphere/airquality/publications/sok/polycylic.html

Toluene (TDI) (Australian Government, Department of Sustainability, Environment, Water, Population and Communities.)
http://www.environment.gov.au/atmosphere/airquality/publications/sok/tdi.html

Toluene (Methylbenzene) (Australian Government, Department of Sustainability, Environment, Water, Population and Communities.)
http://www.environment.gov.au/atmosphere/airquality/publications/sok/toluene.html

Xylene (Australian Government, Department of Sustainability, Environment, Water, Population and Communities.)
http://www.environment.gov.au/atmosphere/airquality/publications/sok/xylenes.html

CSG Treated Wastewater Effluent Release into the Receiving Waters

Preamble

The Queensland Department of the Environment and Resource Management has been issuing licences to permit the discharge of treated Coal Seam Gas water into the headwaters of the Murray Darling Basin (MDB). The MDB provides drinking water for more than three million people, including in many capital cities. It not only provides irrigation and stock water for the main food bowl of easterm Australia but is also the recharge area for the Great Artesian Basin (GAB). The MDB and the GAB comprise eastern Australia's most vital water resources. The MDB is also home to approximately 30,000 wetlands, which are diverse ecosystems that create habitats for a wide variety of flora and fauna. The issuing of licences, which permit the discharge of hazardous levels of contaminants into these vital water resources is an issue, which should be of great concern to all Australians, as the impacts on public health and on river and wetland ecosystems are potentially disastrous.

Analysis of Data from PEN 100067807 (DERM, QLD)

"Release to Waters of Treated CSG Water"

The spreadsheet analysis that was undertaken is based on the Queensland Department of Environment and Resource Management PEN 100067807 (APLNG Walloons Gas Fields Exploration Project). Please refer to the following specific details from the QLD DERM PEN 100067807, with reference to the spreadsheet data and this explanation:

1. C18 (page 9 of 77) which explains that this project is for an 18 month period
2. C19 (page 9 of 77) which explains that the discharge limit for this project is 20 megalitres per day
3. Schedule C Table 3 (pages 11 – 13 of 77) which lists the "Final WaterQuality Release Limits"

In terms of the MDB, this means that APLNG is licensed to release the contaminants, as listed in "Schedule c Table 3" into the Condamine River at a rate of 20 megalitres per day over an 18 month period.

Spreadsheet Data: Analysis of Data from PEN 100067807 (DERM, QLD)

When reading the spreadsheet, please note the following information:

1. The use of US EPA Drinking Water Guidelines
2. The use of WHO Drinking Water Guidelines
3. The use of Australian Drinking Water Guidelines
4. The use of Australian Fresh Water Guidleines

Please also note that a message "LIMIT" or "ALERT" is given where contaminants are at or above the respective limits in each category.

Please refer to the column immediately to the right of the "ALERT" to reference the percentage (%) concentration of this contaminant above the limit.

Please also note that there was no data available to reference many of the contaminants.

Analysis of Spreadsheet Data with Reference to:

"Australian and New Zealand Guidelines for Fresh and Marine Water Quality" – (2000)

According to these guidelines, the following contaminants are above the safe limits by the following amounts:

1.	1,2 Dichlorobenzene DI	by 1250.00%
2.	2,4,5 Trichlorophenol	by 666.66%
3.	2,4 Dichlorophenol DI	by 167.67%
4.	Aluminium	by 740.74%
5.	Ammonia	by 156.25%
6.	Arsenic	by 875.00%
7.	Boron	by 4444.44%
8.	Cadmium	by 3333.33%
9.	Chlorine	by 1250000.00%
10.	Chromium (CRVI)	by 500000.00%
11.	Copper	by 200000.00%
12.	Cyanide	by 2000.00%
13.	Lead	by 1000.00%
14.	Nitrate	by 250.00%
15.	Nitrite	by 294117.65%
16.	Phenol	by 176.47%
17.	Selenium	by 200.00%
18.	Silver	by 500000.00%
19.	Zinc	by 125000.00%

Cadmium bioaccumulates in living organisms. Consequently there is the "*potential for cadmium to cause secondary poisoning in marine systems*". (page 8.3 -112, ANZECC WQG) It is also important to note that Chromium (VI) is highly carcinogenic. The fact that it is highly water soluble makes it very hazardous to all forms of life. Selenium is another element, which is hazardous

due to its capacity to bioconcentrate. According to the ANZECC WQG, "*Food chain uptake, leading to secondary poisoning, is more significant than water uptake*" (page 8.3 136). Further to this, phenol, cadmium, lead and mercury are known endocrine disruptors. "*Disruption to the endocrine system affects hormonal production and distribution, ultimately impinging on basic life functions such as reproduction and the development of the reproductive system, growth, maintenance of the body's internal environment, and the production, utilisation and storage of energy*". (Wilson & Foster 1985 – as quoted in ANZECC WQG, page 8.3 -294).

Given the fact that the listed contaminants are being discharged at rates, which range from being tens, to hundreds and even thousands of times in excess of safe levels, is clear evidence of the extreme threats to our natural environment from the discharge of treated CSG waters into the MDB system.

Please note that there was no data available in the Fresh Water Guidelines for many of the other listed contaminants.

Analysis of Spreadsheet Data with Reference to:

"Australian Drinking Water Guidelines 6" (2004)

According to these guidelines, the following contaminants are above the safe limits:

1. 1,2 Dichloroethene DI by 2000.00%
2. Total Petroleum Hydrocarbons (PAHs) by 2000.00%

It must be noted that 1,2 Dichloroethene DI and PAHs are known carcinogenic and mutagenic agents.

A further 42 contaminants are being discharged at their limits and can therefore be categorised as being at a hazardous level. According to the document, ***Australian Guidelines for Water Recycling: Managing Health & Environmental Risks (Phase 2) Augmentation of Drinking water Supplies May 2008,:*** paragraph 1.2.1 (Guideline Values) states that: *"Ascribed in the drinking water guidelines, the guideline values represent minimum requirements and boundaries for defining safety... Guideline values should never be seen or used as a licence to degrade water quality, to achieve marginal compliance."* It is of concern that this DERM PEN does not seem to comply with Federal Government documents that were written to ensure the preservation of water quality in Australia.

Please note that a large number of the contaminants listed on the spreadsheet are being discharged at levels that are either in excess of recommended levels or are at the limits, according to US EPA and WHO Safe Drinking Water Guidelines and therefore represent health risks in terms of these guideline values.

What is also important to understand is the total amount (kg) of pollutants discharged, not only their concentrations. Certain contaminants that have specific weights heavier than water will accumulate in river sediments and in particular behind weirs and in wetlands. In turn, these will then bioaccumulate in living organisms. Accordingly, the volume of heavy metals and other serious contaminants that are being discharged are of particular concern. These include:

1. Aluminium	a total of 2184.00 kg
2. Arsenic	a total of 76.44 kg
3. Cadmium	a total of 21.84 kg
4. Chromium (VI)	a total of 546.00 kg
5. Copper	a total of 21840.00 kg

6.	Cyanide	a total of 873.60 kg
7.	Lead	a total of 109.20 kg
8.	Manganese	a total of 5460.00 kg
9.	Mercury	a total of 10.92 kg
10.	Molybdenum	a total of 546.00 kg
11.	Nickel	a total of 218.40 kg
12.	Selenium	a total of 109.20 kg
13.	Sulfate	a total of 5460000.00 kg
14.	Xylene	a total of 6552.00 kg

Additionally, the ratio of discharged waste water effluent (L/s) to the flow of the receiving water (L/s) is an important parameter, so that an overall dilution factor can be calculated. At certain times of the year and under certain conditions where evaporation rates are rising, concentration factors would increase. It must also be stated that contaminant concentration could occur downstream of the discharge point in times of drought and extreme heat.

It is very important to note that no data was available for 30 additional contaminants, including the radionuclides strontium and vanadium. A total of 43,680 kilograms of strontium, 546 kilograms of vanadium and 218.46 kilograms of uranium are licensed to be discharged into the Condamine River over the 18 month period of this DERM petroleum exploration number.

According to the **Australian Guidelines for Water Recycling** document, "*Protection of public health is of paramount importance and should never be compromised*" (paragraph 2.1, page 7). According to the results of the spreadsheet analysis, it would seem that this precautionary principle is not being followed. This same document also specifically states that "*Some contaminants should be precluded from discharge (eg ... radionuclides...).*" (paragraph 2.6, page 10)

Another contaminant that is of extreme concern, and for which there is no data as to "safe" limits in either of the Australian Fresh Water Guidelines, Drinking Water Guidelines, WHO or US EPA Drinking Water Guidelines is the biocide dichloromoacetonitrile. This biocide is a skin, eye & sensory organ irritant; respiratory irritant; gastrointestinal & liver irritant. It also causes, brain & nervous system damage; kidney damage and cardiovascular damage, It is carcinogenic, causes damage to the reproductive system and is also mutagenic to the developing foetus.

It is also a major concern that the CSG company mentioned in the DERM PEN 100067807 is required to self-monitor the waste water discharge into the receiving water under the terms of the exploration licence. In paragraph 2.3 (Institutional Capability) of the **Australian Guidelines for Water Recycling** document, it is stated that: *"Regulatory agencies must have the expertise to understand the complexities and challenges of managing and monitoring recycling schemes, and the ability to either audit schemes themselves or critically assess audits undertaken by third parties."* (page 8)

The fact that most Australians are completely unaware of the fact that treated CSG water is being released into the rivers of the Murray-Darling Basin is in itself alarming. In paragraph 2.7 of the **Australian Guidelines for Water Recycling** document (Regulatory Surveillance) it is stated that: *"Independent regulatory surveillance and auditing needs to be applied to drinking water augmentation, and needs to include involvement of public health agencies. The public has a reasonable expectation that such schemes will be subject to rigorous regulatory oversight. Surveillance and auditing verify that recycled water systems are being managed and operated correctly and at a high standard, and that public health is being protected. Outcomes should be published in publicly available reports".* (page 10)

Finally, it must be emphasised that this analysis focuses on one exploration licence held by one company only. It does not take into account the cumulative

effect of other such licences to discharge CSG treated water into the headwaters of the Murray-Darling Basin system (or other river basins that support large populations). With the rapid expansion of CSG projects and the initiation of production licences, the cumulative effects of contaminants from CSG treated wastewater entering the receiving water from numerous discharge points into the Murray-Darling Basin are potentially extremely hazardous in terms of the risks to the natural environment and to public health. The same applies to the integrity, purity and the security of water supplies, as well as the capacity to maintain production of food in terms of its integrity, purity and security of supply.

CONSULTATION

I would like to acknowledge the contributions of the following individuals in the development of the spreadsheet analysis and executive summary:

1. Dr Gavin Mudd

   (Environmental Engineer, Lecturer/Course Director in Environmental Engineering in the Department of Civil Engineering, Monash University)

2. John Thomson

   (B. Sc. Hons)

3. Juraj Chmelik

   (M.Scie. Eng; MIE Aust. RPEQ)

4. Anne Kennedy

   (Secretary, Great Artesian Basin (GAB) Protection Group, Committee Member of ABWUA (NSW Artesian Borewater Users Association.)

LIST OF REFERENCES

1. **US EPA Drinking Water Guidelines**

   http://water.epa.gov/drink/contaminants/index.cfm

2. **WHO Drinking Water Guidelines**

   http://www.who.int/water_sanitation_health/dwq/guidelines4/en/index.html

3. **Australian Drinking Water Guidelines 6 (2004)**

   http://www.nhmrc.gov.au/publications/synopses/eh19syn.htm

4. **Australian and New Zealand Guidelines for Fresh and Marine Water Quality – 2000**
   (also known as the ANZECC Water Quality Guidelines)
   http://www.environment.gov.au/water/policy-programs/nwqms/

5. National Water Quality Management Strategy, ***Australian Guidelines for Water Recycling: Managing Health & Environmental Risks (Phase 2) Augmentation of Drinking Water Supplies March 2008,*** National Resource Management Ministerial Council, Environment Protection & Heritage Council, National Health & Medical Research Council

   http://www.ephc.gov.au/sites/default/files/WQ_AGWR_GL_ADWS_Corrected_Final_%20200809.pdf

6. **Spreadsheet of Products, Chemicals and their Health Effects** (Theo Colborn Ph.D. TEDX, The Endocrine Disruption Exchange – September 2010)
   http://www.endocrinedisruption.com/chemicals.multistate.php

7. **Environmental Authority (Petroleum Activities) PEN 100067807** (DERM, QLD, 29.6.2010) Available from the QLD Department of Environment and Resource Management: enquiries@smartservice.qld.gov.au