16th September, 2009.

Committee Secretary
Senate Standing Committee on Environment, Communications and the Art
PO Box 6100
Parliament House,
Canberra ACT 2600
email: eca.sen@aph.gov.au

Dear Sir/Madam,

**Subject: Impact of mining in the Murray Darling Basin - Public Inquiry Submission**

I have learned that your Committee made a call for public submission on the above topic and I would like contribute to your deliberations. I am a member of the Hunter Valley Protection Alliance but this submission is my own private project.

The aim of the Hunter Valley Protection Alliance is to work towards protecting the environment of NSW Hunter Valley from damages caused by insensitive and irresponsible development.

Whilst the Hunter Valley is not part of the Murray Darling Basin, I ask that you take into account my submissions, nevertheless.

Like the upper reaches of the Darling River, we are a part of the greater Sydney to Bowen Basin. Therefore, I feel that your Committee can benefit by taking our views into account, since the problems I am trying to highlight are the same regardless of the geographical area.

Here in the Valley we are witnessing many negative effects of a rampant industrialization on our Hunter River every day. If we are not careful this river may follow the destruction of Murray Darling soon, and it would then become a legitimate subject of study for your Committee.

Hunter Valley faces many environmental problems. Besides the ever-increasing number of new export coal mines we are here particularly concerned about the new coal seam methane gas industry. Must public media present the coal seam gas as a new, clean and green, transitional fuel that will solve most of our climate change problems for us in the short term. I have yet to find a finance writer who mentions any environmental downsides of the future coal seam methane gas industry. They always concentrate on the rosy projections of the gas production, profits and export figures.

Unfortunately, the CSM industry has not yet found solutions to many technical and environmental problems and some of these may be hard to solve. I am going to concentrate here on only the following four topics but there are many other issues particularly in the health area:

1. What is coal bed methane gas;
2. Danger of damage to fresh water resources by CSM drilling operations;
3. Problems with a safe disposal of toxic CSM production water;
4. Government Legislation covering the CSM exploration and extraction is outdated and ineffective.

**1. What is coal bed methane gas?**

Coal seam methane (CSM) or coal seam gas (CSG) is also known overseas as coal bed gas (CBM) or simply as gas. Australian Mining Atlas provides a Factsheet with an excellent brief overview of the local CSM scene. It describes the CSM extraction as follows:

*CBM is produced by drilling a well into a coal seam, hydraulic fracturing the coal seam then releasing the gas by reducing the water pressure by pumping away the water.* ***Hydraulic fracturing*** *of the coal seam is done by pumping* ***large volumes of water*** *and sand at high pressure down the well into the*

*coal seam which causes it to* ***fracture for distances of up to 400m from the well****. The sand carried in the water is deposited in the fractures to prevent them closing when pumping pressure ceases. The gas then moves through the sand-filled fractures to the well.*

NOTE: The process of hydraulic fracturing is also known as fraccing, fracking, hydrofracking and many other, less common variants.

The Factsheet shows that the areas of Australia, where the CSM gas can be extracted, are huge. In NSW these include Sydney, Gunnedah, Gloucester and Clarence-Moreton Basins. Unfortunately, this document, like most documents produced by gas companies (e.g. AGL Hunter Gas Project ) does not go into any CSM environmental issues. According to AGL they are none.

Huge amount of additional information about coal seam methane gas can be obtained from the World Wide Web links e.g. from Wikipedia, Montana State University, Wyoming State Geological Survey, JourneyOfTheForsaken, unNaturalGas and many other too numerous to list here.

As the following picture of a fully-developed Jonah gas field in Colorado, USA shows only too clearly, the environmental impact of this industry could be huge!

Researching coal seam methane is a scary experience - especially if we imagine that something like this could be right behind our back fence!

2. Danger of damage to fresh water resources by CSM drilling operations

CSM production may destroy good surface fresh water in several ways by: (a) faulty drilling operations, (b) using good fresh water for hydraulic fracturing, (c) causing depletion of the surface water aquifers by de-watering deep coal seams, (d) contaminating underground water by unknown, toxic hydraulic fracturing chemicals.

**(a) Faulty drilling operations**

Most of the drilling operations in CSM projects is not done by the gas companies themselves, but by drilling contractors. Naturally, their interest is to finish the job as quickly and as cheaply as possible. Yet some operations, such as sealing the steel casing of the vertical gas wells with concrete must be

done very carefully. Otherwise either the gas or the toxic production water could escape and contaminate the surface water aquifers. Neither the gas company nor the government supervisors have direct control over the contract labour force. Contractors may be tempted to take shortcuts as demonstrated on the recent Four Corners report, because nobody could really see what happened deep underground.

**(b) Using good water for hydraulic fracturing**

When Sydney Gas drilled exploratory Core Hole 3 in the Hunter Valley at Bulga Inlet they trucked town water from Singleton in the height of our seven years drought when severe water restrictions were current. When Sydney Gas fractured their pilot production wells in their Wyong Gas project they transported fraccing water from a fresh water bore in Cessnock area ( NSW Government Hansard, 3 May 2005). All water that is used for drilling or hydraulic fracturing is lost from the fresh water cycle, forever! The actual quantities are not small. For example this Hydraulic Fracturing Fact Sheet based on US data says:

*Large amounts of chemicals are also used in hydraulic fracturing. In natural gas fracturing, 435 chemical products are known to be used, many of which can be toxic to humans and wildlife, even in very small doses. Although the overall concentration of chemicals in fracturing fluid is around one percent, significant quantities are used – an average of 1,000 gallons of chemicals and 100,000 gallons of water for a standard coalbed methane (CBM) well. Around 20-70 percent of fracturing fluid remains underground, or an average of 20,000 to 70,000 gallons, raising concerns about the potential for contamination of drinking water supplies.*

Thus for fraccing a single CBM well is needed about 100,000 US gallons of water x 3.785 = 378,500 liters or 0.3785 megalitres or 378.5 cubic meters of water. Multiplied by hundreds or thousand of gas wells, that usually comprise an industrial gas field, these quantities of lost fresh water are huge.

(**c) Causing depletion of surface water aquifers by de-watering coal seams**

We have seen that in order to release methane gas from coal seams it is necessary to de-water the coal seams and thus release the underground pressure. This is similar to opening a soft drink bottle. Methane gas then bubbles out, is separated from water and pumped into a processing plant. Water which is mostly saline and toxic to plants must be then disposed of in a responsible manner which is a huge problem in itself.

Detailed Government research from Wyoming , USA ( 1993 – 2006 Coalbed Natural Gas (CBNG), Regional Groundwater Monitoring Report: Powder River Basin ) shows that:

*The extraction of CBNG-produced groundwater from PRB coal deposits has caused widespread public concern about declines in groundwater availability. Between 1987 and 2006, CBNG production in the Wyoming PRB has withdrawn accumulative total of 4.1 billion barrels (174 billion gallons) of groundwater at total pumping rates up to 77.3 million gallons per day (mgd). Based on the BLM deep monitoring well data, water levels in some of the monitored CBNG wells have declined up to 625 feet within the CBNG production areas of the Wyoming PRB.*

The coal seams (or as the Americans say coal beds) in the Powder River Basin are relatively shallow (less then 500m) and often contain fresh water used locally for irrigation. Thus the drop of underground water level of 625 feet x 0.3048 = 190.5 meters is serious. Such a substantial drop will cause many agricultural bores to run dry.

The NSW Hunter Valley coal seams are usually somewhat deeper. Department of Primary Industry researchers, when approving Sydney Gas Wyong project DPI-MR RESPONSE ( I ), insisted that these deeper coal seam and the surface aquifers are not connected. Consequently, they thought that there was no danger to surface water. This notion, often generalised, certainly rings somewhat false. There are both detected and undetected geological fault lines in most geographical areas. The gas companies are actually creating cracks in the strata by hydraulic fracturing. How could they be really sure that the surface water can never, ever find these fractures and disappear into the coal seam voids?

In the Powder River Basin it took almost twenty years before the concerns of aquifer depletion were properly investigated. Pumping rates of 77.3 million gallons per day which corresponds to 77,300,000 mgd x 3,785 = 292,580,500 liters i.e. 292 megalitres per day. These numbers are a bit hard to imagine so here is a comparison. Sydney Harbour at high tide contains 562,000 megalitres. So the amount of water extracted from the Powder River Basin every day is little bit more then **half of the Sydney Harbour!** Those of us who live in the ground zero still remember that Sydney Gas used to be pretty ambitious when they came first into our valley. They talked about new, shiny green gas industry **even greater then Powder River gas fields.** So this is the order of numbers we need to consider when thinking about the future. Incidentally, Powder River Basin now operates something like 50,000 gaswells - the exact figure is very hard to find.

**(d) Contaminating underground water by unknown, toxic and proprietary hydraulic fracturing chemicals**

The real problem with fraccing of gas wells is the secret nature of the toxic chemicals used in the fraccing fluids. The fraccing technology was originally developed by Halliburton and they regard the exact composition of their drilling and fracking compounds an industrial secret. These chemicals were exempt from the Safe Drinking Water Act in 2005 under Bush and Cheney Administration (more).

This review Hydraulic Fracturing of Coalbed Methane Wells:A Threat to Drinking Water shows that they were valid concerns already as far back as 2002

The Endocrine Disruption Exchange provides a list of chemicals used for fraccing of natural gas wells. This list contains names of 435 fracturing products containing 344 chemicals an describes some of their medical effects.

Shaleshock provides a rundown Drilling 101 which covers both drilling and fraccing in the Marcellus shale formation.

The problems associated with fraccing and the environment discussed above, have been neatly summarised in the November, 2008 article in Scientific American entitled "Drill for Natural Gas, Pollute Water". The article not only lists all the important cases but it also shows the secret background. The extent of collusion between the US gas industry and Government regulators in suppressing the truth is frightening.

An up-to-date review of hydraulic fracturing and its conflicts with human habitation are described here in this article: " UNTESTED WATERS: THE RISE OF HYDRAULIC FRACTURING IN OIL AND GAS PRODUCTION AND THE NEED TO REVISIT REGULATION by Hannah Wiseman. The article argues that legislation changes in this area are overdue.

3. Problems with a safe disposal of toxic CSM production water

We have seen here in Section (2c) that the quantities of waste water produced by full scale gas fields are huge - they can be measured in Sydney Harbour units ( **1 sydhab = 500 gigalitres**). This waste water from Queensland CSM gas fields is currently simply stored in huge evaporation ponds like this one:

Queensland Government is by now well aware of this problem and in their recent update of the coal seam methane mining legislation ordered the industry to clean up their act and discontinue the evaporation pond practice within three years (see link). This represents a huge challenge for the Queensland CSM industry and will have serious implications for Australia as a whole. What are the alternatives?

The CSM industry always talks about de-salination plants. Indeed, they have some pilot projects running already (see Making use of water from CSG operations)

This is a well tried technology and it works on a small scale where water is precious. There are essentially two types of de-salination processes: reverse osmosis and thermal desalination (see e.g. Impulse Hydro distributes JetWater thermal desalination system). The first process puts water through batteries of high-tech plastic membranes. The later is simply thermal distillation of waste water. But can anyone seriously imagine putting sydharbs of waste water through microfibres or boiling them out? Where will all the energy for desalination plants come from? From burning CSM of course! But what would that do for the profitability of the industry? There is also talk about desallination using solar energy. This looks quite interesting but is probably still too costly. Hight cost is still the main problem in solar energy generation.

The other approach is to put the CSM waste water back into the ground. The question is where? Obviously, not into the aquifers above the target coal seams. That would destroy the fresh water contained there. How about deep under the target CSM coal seams? Yes, this is possible given that the cost of more drilling and fracccing, to make the space for the waste can be accommodated. Finally, why not return the waste water back into the target coal seams? Yes, this is possible too with more drilling and fraccing. But isn't this the place where we are planning to sequestrate the carbon dioxide from our power stations thus solving the climate change problems once for all? There is also a possibility that pumping huge quantities of water underground near a major fault line may trigger

earthquakes (see here).

The waste water disposal problem is further complicated by the hydraulic fracturing. Twenty to sixty percent of those highly toxic fracturing fluids stay in the wells and come gradually out with production water. These secret toxic chemicals make it pretty risky to re-use the waste water for watering farm animals and crops and even more so for a possible town water use. We note that a lot of our agricultural produce is exported. Even spraying the waste water on dirt roads for dust suppression may not be such a great idea - bulldust is bad enough without being toxic! How about selling the waste water to coal washeries? Once again, our overseas customers, a pretty delicate lot, may not like to handle toxic coal in their home ports and power stations. These proprietary chemicals are a real problem!

4. Government Legislation covering CSM exploration and extraction is outdated and ineffective

Here in NSW the CSM exploration and production is controlled by the Petroleum (Onshore) Act, 1991. If you use the excellent search facilities provided on this website and search for word **methane** you get only one hit. This one:

*(4) This section does not apply to **methane** recovered in conjunction with coal mining operations.*

If we search for **hydraulic fracturing** we get nothing.

If we try to locate regulations that relate to the protection of local residents who are currently living in the future gas fields we need to search for **200 meters:**

**Quote**

***72 Restrictions on rights of holders of titles over other land***

*(1) The holder of a petroleum title must not carry on any prospecting or mining operations or erect any works on the surface of any land:*

*(a) on which, or within 200 metres of which, is situated a dwelling-house that is a principal place of residence of the person occupying it, or*
*(b) on which, or within 50 metres of which, is situated any garden, vineyard or orchard, or*
*(c) on which is situated any improvement (being a substantial building, dam, reservoir, contour bank, graded bank, levee, water disposal area, soil conservation work, or other valuable work or structure) other than an improvement constructed or used for mining or prospecting operations,*
*except with the written consent of the owner of the dwelling-house, garden, vineyard, orchard or improvement (and, in the case of the dwelling-house, the written consent of its occupant).*
*(2) A consent under this section is irrevocable.*
*(3) If need be, the Minister is to determine whether any improvement referred to in subsection (1) (c) is substantial or valuable, and may define an area adjoining any such improvement on the surface of which no prospecting or mining operations are to be carried out, or works erected, without the consent of the owner of the improvement.*
*(4) If a dispute arises as to whether or not this section applies in a particular case, any party to the dispute may apply to the Land and Environment Court for a determination of the matter.*

## That is it! These are all the rights that protect local citizens we could find!

So, how does this Act relate to the nascent CBM industry? Simple! You have to look for "**gaseous**" in the definition of petroleum:

*"petroleum" means:*
*(a) any naturally occurring hydrocarbon, whether in a **gaseous** , liquid or solid state, or*
*(b) any naturally occurring mixture of hydrocarbons, whether in a **gaseous** , liquid or solid state, or*

*(c) any naturally occurring mixture of one or more hydrocarbons, whether in a* ***gaseous*** *, liquid or solid state, and one or more of the following, that is to say, hydrogen sulphide, nitrogen, helium, carbon dioxide and water,*
*and includes any substance referred to in paragraph (a), (b) or (c) that has been returned to a natural reservoir, but does not include coal or oil shale or any substance prescribed to be a mineral for the purposes of the Mining Act 1992 .*

**And here we are!** That is how! Very clever drafting! This is certainly a case where technology advances, such as hydraulic fracturing and horizontal SIS (surface-to-in-seam drilling) that make CSM production possible, have left the legislation long way behind. There may be more legislation around somewhere but nobody told us about it. We are certainly trying to find out more but the current system is not exactly transparent.

So, what needs to be done? First of all, I believe that actually **there may be a case for coal seam methane in Australian energy future** – but in the right place and under strict new regulations.

We need a new and **Federal** act to regulate the whole new CSM industry. In contrast to the current outdated state legislation, the new Act should give more voice to local residents when deciding about the development of any new gas fields. It should be realised that local residents and by extension Local Councils are the only guardians of the local environment who cannot be easily compromised. They live there and have a stake in keeping the environment and water safe. People living in far away cities may have other priorities. At the moment local residents are usually treated as nuisance. We are kept in the dark like mushrooms and fed spin. Everything is decided between gas companies and Government in secrecy and behind closed doors!

Future Federal Government authorities in charge of regulating CBM industry should act in a bold and transparent manner. Background to all important decisions should be immediately explained and published - we already have the web technology to do so. All reports by technical experts should be properly attributed and stored for ever or at least for fifty years. There is nothing secret about the ground we walk on. However, if things go wrong some time in the future, the public has the right to know who was at the helm at the time when the problem was created. This is called democracy and transparency.

These new regulation agencies should also specify and publish on-line all results of their inspections of individual drilling sites. Government inspectors and the gas company experts should be present during all critical parts of the drilling operations such as completion of the new well. Even better, a local community representative should be also present during these inspections.

We do realise that re-writing CSM legislation will be an expensive and difficult task. Maybe it is a pipe dream in the current political climate. However, the alternative is to leave things as they are and find out in ten or twenty years that all our rivers and streams have been destroyed like Murray Darling. We will then realise then that food and fresh water are more precious then energy and profits from the coal seam methane gas.

Regards.
George Tlaskal

P.S. **Declaration of interest**: I am a member of the Hunter Valley Protection Alliance. And YES we have already experienced a gas drilling rig operating right behind our back fence!