From: "Dr Wayne Somerville" <waynes@bordernet.com.au>
To: <csg.review@chiefscientist.nsw.gov.au>
Date: 03/02/2014 10:16 AM
Subject: Scientific Evidence for Claims Regarding the Safety of the CSG Industry

To Professor Mary O'Kane
NSW Chief Scientist & Engineer

Dear Prof O'Kane,

I understand that the time for submissions on CSG operations has passed, but I am writing to ask that you and your colleagues please consider the attached paper in your deliberations.

My report arises from a 14 November 2013 meeting I attended in which Mr Peter Henderson, the CEO of Metgasco, a CSG mining company with PELs in the Northern Rivers, pitched his business to Kyogle's Mayor Danielle Mulholland. Mr Henderson depicted the CSG industry as in all ways safe and beneficial, and made a series of claims presented as fact regarding the nature and safety of the gas mining industry. Afterwards, Mr Henderson offered to follow up on "health concerns" that I raised at the meeting.

I asked Mr Henderson if he would provide the scientific evidence for his specific claims that CSG operations have been proved to be safe, CSG mined in the Northern Rivers is pure methane and contains no impurities, and there is no benzene in coal seams. I also asked Mr Henderson if he would reconcile the documented situation in Queensland gas fields with his claim that any future local processing of CSG would produce no significant pollution.

My ensuing correspondence with Mr Henderson began a much needed evidence-based public discussion of the potential health impacts of CSG industrialisation in populated areas. The attached paper, "Is CSG Safe? A Failed Debate", reports and comments on Mr Henderson's responses to my questions.

Unfortunately, in my opinion, Mr Henderson did not provide any appropriate scientific evidence to support his claims. If Mr Henderson's five pages of response represent the gas industry's "best scientific case" that their operations are proven to be safe, then they have no real evidence.

In his response, Mr Henderson added the claim that with no processing at all, Metgasco's CSG produced water meets "Australian Drinking Water Guidelines, apart from its salt levels" and "after some salt removal, is suitable for irrigation" and "is suitable for stock watering, even without salt removal." Mr Henderson did not provide any data on local produced water, beyond reassurances that assays in his possession cause him no

concern, but he directed me to AGL's Environmental Health Impact Statement. This showed that in AGL's Camden waste water, arsenic, barium, benzene, and Total Petroleum Hydocarbons exceeded Australian Drinking Water standards by 10 or more times, and strontium, nickel, lead, bromine, iodine, fluoride, methane, naphthalene, benzo(b)fluoranthene, and benzo(a)pyrene also exceeded guidelines.

As explained in my attached paper, the industry has not undertaken the basic controlled pre- to post-test research on health effects that is essential to establish the safety and efficacy of a new product or process. There is a glaring inconsistency between pharmaceutical companies having to demonstrate the safety of a new medication with health data obtained from real people, with the approach of the gas industry that eschews the collection of baseline health data and instead relies on "desktop" EIS analyses.

In my opinion, EIS methodology and assumptions might be appropriate for most industrial developments, but they become problematic when applied to proposals to establish industrialised gas fields across large areas of populated, previously rural landscape.

The use of inadequate health guidelines to examine, one at a time, the likely health impacts of each of a large number of pollutants that will be newly released into a rural environment, takes no account of the likely cumulative, synergistic and subtle effects of pollutants which can affect physiological functioning even in minute doses, well below toxic levels.

Your coming report on the CSG industry is going to be hugely important for the long term well-being of rural communities at risk of being exposed to extensive gas field industrialisation.

I respectfully request that you consider my attached paper in your deliberations.

Please do not hesitate to contact me if you require more information, or if I can be of any further assistance.

Yours faithfully,

Wayne Somerville

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Clinical Psychologist
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Is CSG Safe?

A Failed Public Debate in the Interests of Community Health

QGC's Kenya CSG Plant and Gasfield – Tara, Queensland

By Dr Wayne Somerville B.A.(Hons.), M.Clin.Psych., D.Psy. Clinical Psychologist

For further information, please contact:

Dr Wayne Somerville email : waynes@bordernet.com.au

Download copies from the CSG Page at
www.creeksbend.com

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This paper, "Is CSG Safe? - A Failed Public Debate in the Interests of Community Health", supplements my earlier "Self-help Risk Management Tools: A Report on the Health Impacts of CSG and Shale Gas Mining".[1] Copies of both papers are available for free download from the "CSG" page at www.creeksbend.com.

[1] Dr Wayne Somerville (2013) Self-help Risk Management Tools: A Report on the Health Impacts of CSG and Shale Gas Mining, download from the "CSG" page at www.creeksbend.com. http://www.creeksbend.com/CSG%20Health%20Risk%20Management%20Tools%20-%20Dr%20W%20Somerville.pdf

Is CSG Safe?
A Failed Public Debate in the Interests of Community Health

Dr Wayne Somerville B.A.(Hons.), M.Clin.Psych., D.Psy. Clinical Psychologist

Introduction

Heavily industrialised gas fields are being established in populated areas across Australia with little public discussion of potential health risks. When development could negatively affect the health of generations to come, the community is entitled to an open debate based on scientific evidence and rational argument. My recent dialogue with Metgasco CEO Mr Peter Henderson initiated a much-needed public discussion about the potential health impacts of gas field industrialisation in the Northern Rivers.

On 14 November 2013 Metgasco's CEO Mr Peter Henderson and Community Relations Manager Mr Stuart George attended a 90 minute meeting with Kyogle Mayor Danielle Mulholland, Kyogle Shire Council General Manager Mr Arthur Piggott, and myself as a community representative and policy adviser. Mr Henderson called the meeting to promote Metgasco's plans to develop gas fields in the Northern Rivers. Mr Henderson said that if the yet-to-be drilled Bentley gas well is successful, Metgasco will establish a gas field there and build a pipeline along Kyogle's Lions Road to transport gas to the export market. After the 14 November 2013 meeting, Mr Henderson e-mailed me and offered to follow up on "health concerns" that I raised at the meeting.

In subsequent correspondence, I asked Mr Henderson to provide the scientific evidence for his claims that: a) CSG operations have been proved to be safe; b) the CSG mined in the Northern Rivers is pure methane and contains no impurities, or any substance other than some water that requires processing; and c) there is no benzene in coal seams in the Northern Rivers. I also asked Mr Henderson if he could reconcile the situation in Queensland gas fields, where significant quantities of hazardous substances are discharged into the environment, with his claim that any future processing of CSG in the Northern Rivers would produce no significant waste or pollution.

Mr Henderson responded to the above requests in a letter dated 29 November 2013. A copy of this letter is attached to this paper as Appendix A.

Mr Henderson's responding to my request for evidence to support the claims about the safety of the CSG industry that he made at the meeting with Kyogle's Mayor was a welcome first step in an important debate that contrasts two very divergent viewpoints.

In my "Self-help Risk Management Tools: A Report on the Health Impacts of CSG and Shale Gas Mining"[2], I concluded that there is a high probability of potentially catastrophic health impacts from operating gas fields in populated areas. My review of the scientific literature indicated that air, water and soil pollution from unconventional gas mining creates a complex mix of persistent, bio-accumulative, toxic, carcinogenic, mutagenic, teratogenic, and endocrine disrupting substances, some which can seriously injure human health even in minute quantities.

[2] Dr Wayne Somerville (2013) Self-help Risk Management Tools: A Report on the Health Impacts of CSG and Shale Gas Mining, download from the "CSG" page at www.creeksbend.com

In marked contrast, Mr Henderson argued that the CSG industry has been proven to be in all ways safe, and operating gas fields in the Northern Rivers could not expose people to dangerous substances capable of causing illness.

I have considered the arguments and reports cited in Mr Henderson's 29 November 2013 letter and, in my opinion, there was no relevant scientific evidence there to support Mr Henderson's claims regarding the "proven" safety the CSG industry and the composition of local coal seam gas and CSG waste water. Further, Mr Henderson did not explain why CSG processing in the Northern Rivers would not result in pollution similar to that produced by Queensland CSG gas fields and processing plants.

In his 29 November 2013 letter, Mr Henderson did not provide any primary data for the Northern Rivers, but instead cited Australian Gas Light's (AGL) Camden Environmental Health Impact Assessment (EHIA)[3] as a source of relevant information regarding the chemical composition of coal seam gas.

In my opinion, there was nothing in Mr Henderson's 29 November 2013 letter, or the studies and reports he cited, to contradict the conclusion of my risk assessment report[4] that there is a high level risk of potentially catastrophic health impacts associated with operating gas fields in populated areas.

Mr Henderson received a pre-publication copy of this paper and was invited to provide a response to be attached to this document. Mr Henderson was also asked if he would be willing to participate in further public discussion about the potential health impacts of operating gas fields in populated areas. Mr Henderson's response, dated 24 January 2014, is attached to this paper as Appendix B.

The following discussion presents and comments on Mr Henderson's claims regarding the safety of the CSG industry and the nature of coal seams, CSG, and CSG wastewater in the Northern Rivers.

On the Gas Industry

Mr Henderson began his 29 November 2013 letter with the following statements about the energy needs of the community:

> "NSW and Northern Rivers residents need energy for heating, lighting and cooking in their homes and to power domestic appliances. We all need transport fuels and in the work place our jobs depend on reliable energy supplies to power equipment and to provide heating and cooling. Our lives depend on reliable energy supplies."

Most people would agree that our community needs reliable supplies of energy, but it does not follow that operating gas fields in populated areas is necessary, desirable, or safe.

The issue is not "gas versus no gas". The vitally important question is whether it is safe to operate heavily industrialised gas fields where people live.

[3] AGL's Environmental Health Impact Assessment – Camden Northern Expansion Project, 30 October 2013.
[4] Dr Wayne Somerville (2013) Self-help Risk Management Tools: A Report on the Health Impacts of CSG and Shale Gas Mining, download from the "CSG" page at www.creeksbend.com

Is CSG Clean and Green?

In his 29 November 2013 letter, Mr Henderson wrote that:

> "Exports of natural gas from Australia are helping less developed countries to reduce the extent of air pollution and associated illness."

The gas mining industry argues that natural gas is a clean fuel because when burnt it creates less carbon dioxide than coal. But this benefit for consumers is offset by the creation of potentially dangerous air, water and soil pollution where the gas is mined and processed.

On the Composition of Northern Rivers CSG

In his 29 November 2013 letter, Mr Henderson wrote:

> "Our coal seam gas is almost pure methane. The natural gas we produce from our coal seams is about 98% methane, with very small amounts of ethane (another colourless, odourless and non-toxic hydrocarbon gas), carbon dioxide and nitrogen. Gas chromatograph data for our coal seam gas shows virtually no hydrocarbons heavier than ethane. By inspection, there is absolutely no reason for concern in terms of metals, volatile organics or BTEX chemicals. For your information, the gas we found in our Kingfisher exploration well (a conventional gas field) has a similar composition to our CSG. It has a little more ethane and propane than our CSG but gas chromatograph data shows hydrocarbons no heavier than pentane and, again by inspection, provides no reason for concern. Our coal seam gas meets specifications for sales gas, it does not need to be treated to be sold into the gas market. It might need to have small quantities of water removed to be distributed in a large pipeline system."
>
> "Should you wish to explore the wealth of data that is available on websites you will find that gas produced from other Australian coal seams is also primarily methane, with very low concentrations of any hydrocarbons heavier than ethane. For example, we draw your attention to AGL's Environmental Health Impact Assessment – Camden Northern Expansion Project, 30 October, 2013, provides further information to support high methane levels and correspondingly low levels of heavier hydrocarbons in its gas. Again, by inspection, there is no reason for concern about volatile organic compounds, BTEX or metals. This information can be found on the AGL website."

In his letter, Mr Henderson stated that local CSG consists of methane, ethane, carbon dioxide, nitrogen and "virtually no hydrocarbons heavier than ethane". I note that a definition of "virtually" is "in essence or effect but not in fact".

It is not clear whether Mr Henderson's statement, "By inspection, there is absolutely no reason for concern in terms of metals, volatile organics or BTEX chemicals" indicates that none of these potentially dangerous substances is present in local coal seam gas, or that he is personally unconcerned when he looks at chemical assay reports.

As Mr Henderson suggested, I read AGL's EHIA[5], but could find nothing there to support his claim that AGL's, and by implication Metgasco's, CSG was "almost pure methane" with no other substance worthy of "concern".

[5] AGL's Environmental Health Impact Assessment – Camden Northern Expansion Project, 30 October 2013

The following table from AGL's EHIA presents data from testing of coal seam gas at their Camden operation.

Table 4.5 Screening Level Review of Fugitive Emissions from Proposed Wells – Northen Expansion.[6]

Table 4.5 Screening Level Review of Fugitive Emissions from Proposed Wells – Northern Expansion

Component of CSG (all compounds detected)	Composition from Analysis (%)**	Predicted Worst-case Downwind Air Concentration		Screening Level Guideline
		At well head (within 5 m)	50 m from well	
Total gas release as CO_2 equivalents	100% - 0.026 g/s emission	22000 µg/m^3	1678 µg/m^3	NA
Methane	90%	19800 µg/m^3 or 0.003%	1510 µg/m^3 or 0.0002%	>0.5% in buildings[V] 5% explosive risk
Nitrogen	up to 5%	1100 µg/m^3 or 0.00006%	83.9 µg/m^3 or 0.000005%	NA - Negligible contribution to ambient levels
Oxygen	1.5%	330 µg/m^3 or 0.00003%	25 µg/m^3 or 0.000002%	Negligible contribution to ambient levels
Carbon dioxide	3.2%	704 µg/m^3 or 0.00004%	54 µg/m^3 or 0.000003%	0.5% in buildings[V]
Argon	<1%	<220 µg/m^3 or 0.00001%	<17 µg/m^3 or 0.000001%	NA - Negligible contribution to ambient levels
Ethane	<0.2%	<44 µg/m^3	<3.3 µg/m^3	NA – TLV = 1 230 000 µg/m^3 (ACGIH), HSDB does not report effects in the few studies available at higher levels of exposure. No public health guideline
Propane	<0.01%	<2.2 µg/m^3	<0.17 µg/m^3	NA – TLV = 1 800 000 µg/m^3 (ACGIH), HSDB lists no effects in other studies up to this level of exposure. No public health guideline available
Acetone	180 µg/m^3 0.000008%	0.0018 µg/m^3	0.00013 µg/m^3	30000 µg/m^3 based on chronic public health guideline from ATSDR
Ethanol	550 µg/m^3 0.00003%	0.0066 µg/m^3	0.00050 µg/m^3	100000 µg/m^3 based on chronic public health guideline from OEHHA
Hexane	250 µg/m^3 0.000007%	0.0015 µg/m^3	0.00012 µg/m^3	700 µg/m^3 based on chronic public health guideline from USEPA*
Cyclohexane	260 µg/m^3 0.000008%	0.0018 µg/m^3	0.00013 µg/m^3	6000 µg/m^3 based on chronic public health guideline from USEPA*
TPH C5-C6 aliphatics	3420 µg/m^3 0.0001%	0.022 µg/m^3	0.0017 µg/m^3	18400 µg/m^3 based on chronic public health guideline from TPHCWG
TPH >C8-C10 aliphatics	40600 µg/m^3 0.0008%	0.18 µg/m^3	0.013 µg/m^3	1000 µg/m^3 based on chronic public health guideline from TPHCWG
TPH >C10-C12 aliphatics	4770 µg/m^3 0.00007%	0.015 µg/m^3	0.0012 µg/m^3	

Environmental Health Impact Assessment – Camden Northern Expansion Project
Ref: AGL/13/CNHIA001-F
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Note. "TPH" means Total Petroleum Hydrocarbons.

[6] AGL's Environmental Health Impact Assessment – Camden Northern Expansion Project, 30 October 2013, Page 39

The Report of Analysis of a sample of CSG on the following Page 8 of this paper is from Appendix A of the AGL EHIA.

I note that the "LOR", or "Limit of Reporting", figures used in the following AGL EHIA Report of Analysis represent arbitrary cut-off points for reporting the presence and quantity of the indicated substance. According to the Wisconsin Analytical Detection Limit Guidance and Laboratory Guide for Determining Method Detection Limits[7],

> "Reporting Limit is an arbitrary number below which data is not reported. The reporting limit may or may not be statistically determined, or may be an estimate that is based upon the experience and judgement of the analyst. Analytical results below the reporting limit are expressed as 'less than' the reporting limit. **Reporting limits are not acceptable substitutes for detection limits unless specifically approved by the Department for a particular test**". (Page 2, bold type in original).

The AGL EHIA "Report of Analysis" of Camden coal seam gas reported the presence, above the "limit of reporting", of ethanol, dichloromethane, hexane, cyclohexane, heptane, styrene, benzene, toluene and ethylbenzene.

Significant differences are apparent when Mr Henderson's claims about the composition of Northern Rivers CSG are compared to data in Table 4.5 and the "Report of Analysis" in the AGL EHIS. For example, Mr Henderson claimed that local CSG "is about 98% methane", while AGL reported that their CSG is 90% methane. More importantly, AGL reported the presence in their CSG of many substances other than methane, including BTEX chemicals and other Volatile Organic Compounds (VOCs).

In his 29 November 2013 letter, Mr Henderson did not provide any direct data to support his claim that benzene does not exist in coal seams.

I note that the Queensland Government's Department of Environment and Heritage Protection website advises that "BTEX compounds are found naturally in crude oil, coal and gas deposits and therefore they can be naturally present at low concentrations in groundwater near these deposits."

In regards to the presence of benzene and other BTEX chemicals in coal seams, the AGL EHIS noted that:

> "There are have been (sic) a few detections of low concentrations of benzene, toluene, ethylbenzene and xylene (BTEX) in production water. BTEX is not used for any aspect of the process (drilling, hydraulic fracturing or maintenance), however a review of the nature of the target coal seam by CSIRO (Volk et al. 2011) has identified the likely presence of low levels of BTEX in the target coal seam aquifer. The small number of low level detections reported from some existing wells is consistent with the presence of BTEX in the target coal seam aquifer."[8]

[7] Wisconsin Department of Natural Resources, Laboratory Certification Program (1996) Analytical Detection Limit Guidance & Laboratory Guide for Determining Method Detection Limits, April 1996, PUBL-TS-056-96.
[8] AGL's Environmental Health Impact Assessment – Camden Northern Expansion Project, 30 Oct 2013, Pg 60.

Report of Analysis of CSG from Appendix A of AGL's EHIA, 30 October 2013[9]

Australian Government

National Measurement Institute

NATA

REPORT OF ANALYSIS

Report No. VOC13_267

Client	: AGL	**Job No.:**	AGLU01/130917
	PO BOX 67	**Quote No.:**	
	MENANGLE NSW 2568	**Order No.:**	
		Date Sampled:	12-Sep-2013
		Date Received:	17-Sep-2013
		Sampled by:	CLIENT
Attention	: AARON CLIFTON		
Project Name	:		
Your Client Services Manager	: DANNY SLEE	**Phone:**	(02) 9449 0111

Laboratory Reg. No.:	NV13/00802	**Method:**	VOC_01
Client Sample Ref.:	RPGP120913	**Date Analysed:**	18-Sep-2013
Matrix:	Air Canisters	**Canister No.:**	F1905
Description:	12.9.13 5:35 12.9.13 5:55	**Receipt Vac/Press ("Hg):**	-5
		Dilution:	20

Compound	LOR ppbv	Level ppbv	LOR ug/m3	Level ug/m3	CAS Number
Propene	2	<2	3	<3	115-07-1
Dichlorodifluoromethane	2	<2	10	<10	75-71-8
Chloromethane	5	<5	10	<10	74-87-3
1,2-Dichlorotetrafluoroethane	2	<2	10	<10	76-14-2
Vinyl chloride	2	<2	5	<5	75-01-4
1,3-Butadiene	2	<2	4	<4	106-99-0
Bromomethane	8	<8	30	<30	74-83-9
Chloroethane	2	<2	5	<5	75-00-3
Acrolein	2	<2	5	<5	107-02-8
Acetone	5	<5	10	<10	67-64-1
Ethanol	5	290	9	550	64-17-5
2-Propanol	2	<2	5	<5	67-63-0
Trichlorofluoromethane	2	<2	10	<10	75-69-4
1,1-Dichloroethene	2	<2	8	<8	75-35-4
Dichloromethane	5	<8	20	<30	75-09-2
1,1,2-Trichloro-1,2,2 trifluoroethane	2	<2	20	<20	76-13-1
Carbon disulfide	2	<2	6	<6	75-15-0
trans-1,2-Dichloroethene	2	<2	8	<8	156-60-5
1,1-Dichloroethane	2	<2	8	<8	75-34-3
Methyl-tert-butylether (MTBE)	2	<2	7	<7	1634-04-4
Vinyl acetate	2	<2	7	<7	108-05-4
2-Butanone (MEK)	2	<2	6	<6	78-93-3
cis-1,2-Dichloroethene	2	<2	8	<8	156-59-2
Hexane	2	71	7	250	110-54-3
Chloroform	2	<2	10	<10	67-66-3
Ethyl Acetate	2	<2	10	<10	141-78-6
Tetrahydrofuran	2	<2	6	<6	109-99-9
1,2-Dichloroethane	2	<2	8	<8	107-06-2
1,1,1-Trichloroethane	2	<2	10	<10	71-55-6
Benzene	5	<20	20	<50	71-43-2

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National Measurement Institute

[9] AGL's Environmental Health Impact Assessment – Camden Northern Expansion Project, 30/10/2013, App A.

Report No. VOC13_267

Carbon tetrachloride	2	<2	10	<10	56-23-5
Cyclohexane	2	74	7	250	110-82-7
1,2-Dichloropropane	2	<2	9	<9	78-87-5
Bromodichloromethane	2	<2	10	<10	75-27-4
Trichloroethene	2	<2	10	<10	79-01-6
1,4-Dioxane	2	<2	7	<7	123-91-1
Heptane	2	<10	8	<60	142-82-5
Methyl methacrylate	2	<2	8	<8	80-62-6
cis-1,3-Dichloropropene	2	<2	9	<9	10061-01-5
4-Methyl-2-pentanone (MIBK)	2	<2	8	<8	108-10-1
trans-1,3-Dichloropropene	2	<2	9	<9	10061-02-6
1,1,2-Trichloroethane	2	<2	10	<10	79-00-5
Toluene	2	<4	8	<20	108-88-3
2-Hexanone (MBK)	2	<2	8	<8	591-78-6
Dibromochloromethane	2	<2	20	<20	124-48-1
1,2-Dibromoethane	2	<2	20	<20	106-93-4
Tetrachloroethylene	2	<2	10	<10	127-18-4
Chlorobenzene	2	<2	9	<9	108-90-7
Ethylbenzene	2	<6	9	<30	100-41-4
Bromoform	2	<2	20	<20	75-25-2
m & p-Xylenes	5	<5	20	<20	108-38-3 / 106-42-3
Styrene	2	<6	9	<20	100-42-5
1,1,2,2-Tetrachloroethane	2	<2	10	<10	79-34-5
o-Xylene	2	<2	9	<9	95-47-6
4-Ethyltoluene	2	<2	10	<10	622-96-8
1,3,5-Trimethylbenzene	2	<2	10	<10	108-67-8
1,2,4-Trimethylbenzene	2	<2	10	<10	95-63-6
Benzyl Chloride	2	<2	10	<10	100-44-7
1,3-Dichlorobenzene	2	<2	10	<10	541-73-1
1,4-Dichlorobenzene	2	<2	10	<10	106-46-7
1,2-Dichlorobenzene	2	<2	10	<10	95-50-1
1,2,4-Trichlorobenzene	2	<2	10	<10	120-82-1
Hexachlorobutadiene	2	<2	20	<20	87-68-3
Naphthalene	2	<2	10	<10	91-20-3
Internal Standard: BCM (%Rec.)	1	108			74-97-5
Internal Standard: 1,4-DFB (%Rec.)	1	102			540-36-3
Internal Standard: MCB-d5 (%Rec.)	1	105			3114-55-4

Robert Crough
Chemist
Accreditation No. 198

20-Sep-13

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The issue of the presence or absence of benzene as a CSG pollutant in the Northern Rivers is further highlighted by a comparison of Mr Henderson's description of Metgasco's waste water with data provided by AGL from their Camden operation.

On the Composition of Metgasco's CSG Waste Water

In his 29 November 2013 letter, Mr Henderson claimed that Metgasco's CSG waste water is suitable, without treatment, for stock watering, and with removal of some salt, for irrigation and human consumption.

Specifically, Mr Henderson wrote that:

> "A thorough analysis of our CSG produced water shows that it meets Australian Drinking Water Guidelines, apart from its salt levels, which are about 1/10 of the level in sea water. Bioassay (acute toxicity) testing has provided further and broader confirmation that the CSG water is not toxic. We have a range of studies to demonstrate that our water, after some salt removal, is suitable for irrigation. It is suitable for stock watering, even without salt removal."

Mr Henderson provided no primary data to support his claims about Metgasco's CSG waste water, but offered his personal opinion regarding the significance of the analyses in the "range of studies" he has access to. In the absence of any local data, I examined the AGL EHIA that Mr Henderson referred to for information about the composition of CSG waste water from AGL's Camden operation.

The following table Table 7.2 from the AGL EHIA presents an analysis of chemicals in AGL's Camden CSG waste water. In Table 7.2, substances highlighted in grey were present in CSG waste water at levels exceeding Australian drinking water guidelines.

The pollutants in AGL's CSG waste water that exceeded Australian drinking water guidelines included arsenic, strontium, barium, nickel, lead, bromine, iodine, fluoride, methane, naphthalene, benzo(b)fluoranthene, benzo(a)pyrene, benzene, and Total Petroleum Hydrocarbons (TPHs) in the range C10 to C36. The maximum readings for arsenic, barium, benzene and the TPHs exceeded drinking water standards by 10 or more times, and naphthalene exceeded the drinking water standard threefold.

I note that AGL reported a reading of 10 micrograms per litre in the maximum recording of benzene in their waste water - a level ten times greater than the 1 µg/L drinking water standard.

The substantial variations between minimum and maximum readings evident in AGL's CSG waste water assays indicate that multiple analyses are needed to accurately assess the chemical composition of CSG and CSG waste water.

Unfortunately, only minimum and maximum levels of chemicals are reported in Table 7.2 of AGL's EHIS, and there is no information regarding the number and distribution of readings that were within the minimum to maximum range.

It is not known what analyses or standards Mr Henderson is using to support his claims that CSG wastewater in the Northern Rivers is safe and free of dangerous pollutants even without processing.

Table 7.2 from AGL's Environmental Health Impact Assessment – Camden Northern Expansion Project, 30 October 2013.[10]

Table 7.2 Preliminary Review of Chemicals Detected in Produced Water (existing operations)

Analyte grouping/Analyte	Units	Range of Concentrations in Produced Water		Drinking Water Guideline			Comments
		Minimum	Maximum	Health Based	Aesthetic	Reference	
Total Dissolved Solids (Calc.)	mg/L	5320	23500	--	600	NHMRC 2011	Salinity of produced water not suitable for drinking water
Sulfate as SO_4^{2-} Turbidimetric	mg/L	1	202	500	250	WHO 2011	
Chloride	mg/L	93	1310	--	250	NHMRC 2011	Common in groundwater and certain catchments (from natural mineral salts)
Metals and Inorganics							
Aluminium	mg/L	<0.01	0.07	16	0.2	USEPA 2012a, NHMRC 2011	NHMRC guideline relevant to aesthetics only
Arsenic	mg/L	<0.001	0.113	0.01	--	NHMRC 2011	
Boron	mg/L	<0.05	0.26	4	--	NHMRC 2011	
Strontium	mg/L	0.151	10.2	9.3	--	USEPA 2012a	
Barium	mg/L	0.448	35.5	2	--	NHMRC 2011	
Beryllium	mg/L	<0.001	<0.001	0.06	--	NHMRC 2011	
Cadmium	mg/L	<0.0001	0.0003	0.002	--	NHMRC 2011	
Cobalt	mg/L	<0.001	0.001	0.0047	--	USEPA 2012a	
Uranium	mg/L	<0.001	0.002	0.017	--	NHMRC 2011	
Chromium	mg/L	<0.005	0.012	0.05	--	NHMRC 2011	Guideline based on chromium VI
Copper	mg/L	<0.001	0.025	2	1	NHMRC 2011	
Manganese	mg/L	<0.001	0.133	0.5	0.1	NHMRC 2011	
Molybdenum	mg/L	<0.001	0.138	0.05	--	NHMRC 2011	
Nickel	mg/L	<0.001	0.024	0.02	--	NHMRC 2011	
Lead	mg/L	<0.001	0.026	0.01	--	NHMRC 2011	
Selenium	mg/L	<0.01	0.01	0.01	--	NHMRC 2011	
Vanadium	mg/L	<0.01	<0.01	0.078	--	USEPA 2012a	
Zinc	mg/L	<0.005	0.074	4.7	3	USEPA 2012a, NHMRC 2011	NHMRC guideline relevant to aesthetics only
Iron	mg/L	<0.05	15.4	11	0.3	USEPA 2012, NHMRC 2011	NHMRC guideline relevant to aesthetics only
Bromine	mg/L	<0.1	5.7	2	--	WHO 2011	Lower value calculated for a young child for bromide
Iodine	mg/L	<0.1	0.8	0.16	0.15	USEPA 2012, NHMRC 2011	NHMRC guideline relevant to aesthetics only
Mercury	mg/L	<0.0001	<0.0001	0.001	--	NHMRC 2011	
Silica	mg/L	<0.1	40.7	--	80	NHMRC 2011	
Fluoride	mg/L	<0.1	3.9	1.5		NHMRC 2011	
Ammonia as N	mg/L	<0.01	11.3	30	0.5	USEPA 2012b and NHMRC 2011	Health based value is a lifetime health advisory derived by the USEPA (2012), NHMRC only presents a guideline based on aesthetics
Nitrite as N	mg/L	<0.01	0.42	3	--	NHMRC 2011	
Nitrate as N	mg/L	<0.01	0.19	50	--	NHMRC 2011	
C1 - C4 Hydrocarbon Gases							
Methane	µg/L	290	10500	10000	--	US	US Investigation level for methane in water (flammability/explosive risks, action level at 28000 µg/L). No guidelines are available for the rest of the C1-C4 gases and the hazards are equivalent to those identified for methane, hence this group has been assessed together (sum total) and compared with the methane investigation level
Ethene	µg/L	<10	<10				
Ethane	µg/L	16	16				
Propene	µg/L	<10	<10				
Propane	µg/L	<10	<10				
Butene	µg/L	<10	<10				
Butane	µg/L	<10	<10				

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Ref: AGL/13/CNHIA001-F

[10] AGL's Environmental Health Impact Assessment – Camden Northern Expansion Project, 30 October 2013, Table 7.2, Page 59-60.

Analyte grouping/Analyte	Units	Range of Concentrations in Produced Water		Drinking Water Guideline			Comments
		Minimum	Maximum	Health Based	Aesthetic	Reference	
Phenolic Compounds							
Phenol	µg/L	1.5	1.5	4500	--	USEPA 2012a	
2-Methylphenol	µg/L	1.5	1.5	720	--	USEPA 2012a	
3- & 4-Methylphenol	µg/L	<2.0	<2.0	1100	--	USEPA 2012a	
2-Nitrophenol	µg/L	<1.0	<1.0	60	--	USEPA 2012b	
2.4-Dimethylphenol	µg/L	<1.0	<1.0	270	--	USEPA 2012a	
2.4-Dichlorophenol	µg/L	<1.0	<1.0	35	--	USEPA 2012a	
2.6-Dichlorophenol	µg/L	<1.0	<1.0	35	--		Guideline for 1,4-dichlorophenol adopted
4-Chloro-3-Methylphenol	µg/L	<1.0	<1.0	35	--		Guideline for 2,4-dichlorophenol adopted
2.4.6-Trichlorophenol	µg/L	<1.0	<1.0	9	--	USEPA 2012a	
2.4.5-Trichlorophenol	µg/L	<1.0	<1.0	890	--	USEPA 2012a	
Pentachlorophenol	µg/L	<2.0	<2.0	10	--	NHMRC 2011	
Polynuclear Aromatic Hydrocarbons							
Naphthalene	µg/L	<1.0	19.2	6.1	--	USEPA 2012a	
Acenaphthylene	µg/L	<1.0	<1.0	400	--		Guideline for acenaphthene adopted
Acenaphthene	µg/L	<1.0	<1.0	400	--	USEPA 2012a	
Fluorene	µg/L	<1.0	12.9	220	--	USEPA 2012a	
Phenanthrene	µg/L	<1.0	18.5	630	--		Guideline for fluoranthene adopted
Anthracene	µg/L	<1.0	<1.0	1300	--	USEPA 2012a	
Fluoranthene	µg/L	<1.0	<1.0	630	--	USEPA 2012a	
Pyrene	µg/L	<1.0	2.4	87	--	USEPA 2012a	
Benz(a)anthracene	µg/L	<1.0	<1.0	0.1	--	TEF	See Note 1
Chrysene	µg/L	<1.0	1	1	--	TEF	See Note 1
Benzo(b)fluoranthene	µg/L	<1.0	1.8	0.1	--	TEF	See Note 1
Benzo(k)fluoranthene	µg/L	<1.0	<1.0	0.1	--	TEF	See Note 1
Benzo(a)pyrene	µg/L	<0.5	1.1	0.01	--	NHMRC 2011	
Indeno(1.2.3.cd)pyrene	µg/L	<1.0	<1.0	0.1	--	TEF	See Note 1
Dibenz(a.h)anthracene	µg/L	<1.0	<1.0	0.01	--	TEF	See Note 1
Benzo(g.h.i)perylene	µg/L	<1.0	1.7	1	--	TEF	See Note 1
BTEX							
Benzene	µg/L	<1	10	1	--	NHMRC 2011	
Toluene	µg/L	<5	16	80	25	NHMRC 2011	
Ethylbenzene	µg/L	<2	5	300	3	NHMRC 2011	
Total Xylenes	µg/L	<4	46	600	20	NHMRC 2011	
Total Petroleum Hydrocarbons							
C6 - C9 Fraction	µg/L	20	80	90 to 15000	--	WHO 2011	
C10 - C14 Fraction	µg/L	60	21700	90 to 300	--	WHO 2011	
C15 - C28 Fraction	µg/L	180	38800	90	--	WHO 2011	
C29 - C36 Fraction	µg/L	130	17200	90	--	WHO 2011	

Note 1: TEF = toxicity equivalent factor adopted to derive the guideline based on the guideline adopted for benzo(a)pyrene. The TEF relates to carcinogenic PAHs and relates the toxicity of individual carcinogenic PAHs to the most well studied PAH, benzo(a)pyrene, using a factor (ranging from 1 to 0.01) as per (CCME 2010).

On CSG Pollution in Queensland and Northern Rivers Gas Fields

At the 14 November 2013 meeting, and in my subsequent correspondence, I asked Mr Henderson if he could reconcile the known discharges of pollution in Queensland gas fields with his claim that processing in Northern Rivers CSG gas fields would result in no significant waste products or pollution.

In response to Mr Henderson's request for further information regarding my reference to pollutants in Queensland gas fields, my 20 November 2013 e-mail to Mr Henderson included the following information from Lloyd-Smith and Senjen (2011)[11] and data provided by CSG companies to the Australian National Pollutant Inventory.

[11] Lloyd-Smith, M. and Senjen, R. (2011) Hydraulic Fracturing in Coal Seam Gas Mining: The Risks to Our Health, Communities, Environment and Climate. http://ntn.org.au/wp/wp-content/uploads/2012/04/NTN-CSG-Report-Sep-2011.pdf

In my 20 November 2013 email to Mr Henderson, I replied:

> "Referring to Queensland CSG operations, Lloyd-Smith and Senjen (2011) wrote: 'Permits are provided for the release of wastewater produced in association with the fracking process. In one authorisation for one CSG company (i.e., Schedule C, Australian Pacific LNG Pty Ltd Environmental Authority No. PEN100067807) the release of treated water into the Condamine River was authorised for a period of 18 months at a maximum volume of 20 megalitres (ML) per day.'"
>
> "Over 80 chemical compounds as well as radionuclides were listed in the permit and included a range of persistent, bioaccumulative toxic substances such as nonylphenols, Bisphenol A (BPA), chlorobenzenes, bromides, lead, cadmium, chromium, mercury, BTEX."
>
> "There was no requirement for an assessment of the cumulative load or the potential to contaminate sediment, plants, aquatic species and /or animals prior to release. While release limits were included for the listed compounds, the majority of these were not based on the ANZECC water guidelines as many of the chemicals were not listed in the ANZECC guidelines or were marked as having insufficient data to set a water quality guideline."
>
> "Table 3 provides volumes and quantities of a selection of compounds permitted for release into the Condamine River over an 18 month period."
>
> Table 3. Waste Water Permit (Total as Release rate X 20ML X 547.5days/18mths)

Chemical compound	Release rate/day	Total
BPA	200g/ML	2,298KG (2.298 tonnes)
Bromide	7,000g/ML	76,650KG (76.65 tonnes)
Total Chlorobenzenes	1,840g/ML	20,148KG (20.148 tonnes)
Monochloramine	3,000g/ML	32,850KG (32.85 tonnes)
Nitrate	50,000g/ML	5,475,000KG (5,475 tonnes)
Uranium	20g/ML	219KG
Toluene	800g/ML	8,760KG (8.76 tonnes)
Xylene	600g/ML	6,570KG (6.57 tonnes)
Ethylbenzine	300g/ML	3,285KG (3.285 tonnes)
Benzene	1g/ML	10.95KG
Cyanide	80g/ML	876KG
Lead	10g/ML	109.5KG

My 20 November 2013 e-mail to Mr Henderson also included the following information from the Australian National Pollutant Inventory.

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http://ntn.org.au/wp/wp-content/uploads/2012/04/NTN-CSG-Report-Sep-2011.pdf

2011/2012 National Pollutant Inventory reports of Total Air Pollution for:
A) ARROW ENERGY (DAANDINE) PL, Daandine Gas Field - Dalby, QLD;
B) QGC P/L, Kenya Processing Plant and Compressor Stations – Tara, QLD; and
C) QGC P/L, Windibri Processing Plant & Compressor Stations-Condamine, Qld.

Substance	A) Arrow Dalby Air Total (kg)	B) QGC Tara Air Total (kg)	C) QGC Condamine Air Total (kg)
Arsenic & compounds	0.27		
Beryllium & compounds	0.013		
Cadmium & compounds	0.016		
Carbon monoxide	140,000	520,000	500,000
Chromium (III) compounds	3.1		
Copper & compounds	1.3		
Fluoride compounds	8.9	17,000	
Formaldehyde (methyl aldehyde)	13,000	47,000	42,000
Lead & compounds	1.6		
Mercury & compounds	0.0027		
Nickel & compounds	2.2		
Oxides of Nitrogen	210,000	840,000	850,000
Particulate Matter 10.0 um	13,000	2,700	8,300
Particulate Matter 2.5 um	73	2,700	8,200
Polycyclic aromatic hydrocarbons	0.044		
Sulfur dioxide	190	690	640
Total Volatile Organic Compounds	30,000	110,000	99,000
On-site long term waste storage		17,000	

Note: Air Total = Air Point + Air Fugitive

In his 29 November 2013 letter, Mr Henderson did not directly address the apparent disparity between the documented discharge into the environment of pollutants in Queensland gas fields and his claim that CSG processing in the Northern Rivers would involve no significant pollution. Instead, Mr Henderson wrote:

> "Your comment '*When we export coal we do so with its impurities. But with gas the impurities are taken out here and they are dumped on the environment and the local community'* is simply incorrect and unnecessarily alarmist. The air emissions you quote for Queensland CSG operations are mainly from engine exhausts, no different in nature from any other engine exhausts, including cars, tractors and farm equipment. The emissions are not 'impurities' removed from the gas." (Italics in original)

It is not clear why Mr Henderson described as "simply incorrect" my comment that impurities are removed from coal seam gas in Australia and dumped on local environments and communities. Presumably, CSG wastes in the form of drilling chemicals and muds, flared and vented gases, fugitive emissions, evaporations from waste water ponds, produced water from coal seams, contaminants removed by reverse osmosis filtration, impurities filtered from the gas, and pollutants created during processing, are not exported overseas, and are therefore discharged into local environments.

On their website, QGC describes their compressor and processing stations as removing "impurities" from CSG prior to transport via pipeline. As these impurities are not exported overseas, they presumably contribute to the pollutants discharged into the air as documented in QGC's reports to the National Pollutant Inventory (see above).

It is not clear what Mr Henderson means by his comment that the documented air pollution from Queensland CSG gas fields and compressor/processing stations is "mainly from engine exhausts, no different in nature from any other engine exhausts, including cars, tractors and farm equipment". In regards to the health impacts of CSG operations, it seems irrelevant whether the pollutant or dangerous substance that people are exposed to originated in the coal seam, was added by the miners, or entered the environment as a result of the burning of fossil fuels during processing of the gas.

On the Safety of the CSG Industry

In regards to the "proven" safety of the CSG industry, in his 29 November 2013 letter Mr Henderson wrote:

> "Contrary to points you have previously raised, the safety of CSG and the broader oil and gas industry has been examined and demonstrated."
>
> "….our industry has a proven and safe track record over a number of decades."
>
> "CSG has operated in Australia for nearly 20 years without health problems. AGL's CSG project at Camden, on the outskirts of Sydney, has been operating safely for nearly 13 years with 144 wells drilled in the Macarthur Region."
>
> "CSG in Australia has operated in Australia for nearly 20 years, without any health concerns. There are now about 4000 wells drilled, without health concerns.
>
> "The industry is heavily regulated and there are numerous studies to demonstrate health and safety."
>
> "The CSG and petroleum industry is heavily regulated and must pass stringent health, safety and environmental checks before developments can proceed. There are numerous studies available to show that CSG operations represent a low health risk to the community."

In his 29 November 2013 letter, Mr Henderson cited the Australian Institute of Petroleum's (AIP) Health Watch program, the Queensland Government's report on health problems in Tara, AGL's Camden Northern Expansion Project Environmental Health Impact Assessment, and the recent Public Health England report, as providing scientific support for his claim that the CSG industry has been proved to be safe.

In my opinion, Mr Henderson's arguments, and the studies he cited, do not provide scientific evidence to support his claim that the CSG industry has been proved to be safe. Rather, there is much in the studies and reports cited by Mr Henderson to support my assessment that there is a high level risk of potentially catastrophic health impacts associated with operating industrialised gas fields in populated areas.

A discussion of what constitutes scientific "proof", and the questions that various kinds of studies can address, will be followed by a brief review of what the AIP Health Watch program, the Queensland Government's CSG Health Report, AGL's Camden Northern Expansion Project EHIP, and the Public Health England Report tell us about the safety of the CSG industry.

Scientific "Proof" and Research Design

Findings from randomised, controlled experimental trials are the closest that scientists can come to "proof" that some "intervention" (e.g., a medical treatment, living near a CSG gas field etc) has or does not have an effect. The basic requirement is that data obtained from "experimental" subjects, both before and after they are exposed to the "intervention", is compared with pre- and post-test data obtained from "control" subjects who are similar to the experimental subjects, except that they do not experience the intervention.

For instance, to prove the efficacy and/or safety of a new medication, health data obtained before and after "experimental subjects" take the medication are compared with corresponding results obtained from "control subjects" who take a convincing "placebo" or "sugar pill" fake medication. If and only if these conditions are satisfied, can it be concluded that a medication is effective and/or safe.

If the experimental trial only obtains pre-test and post-test data from subjects who take the new medication, with no control group, then it can not be concluded that any observed changes are due to the effects of the medication. A comparison with control group subjects is necessary to rule out the influence of such extraneous factors as natural change over time, random events, and the expectations of subjects.

The "burden of proof" is on the pharmaceutical company that wants to sell a new, potentially hazardous medication to the public, and well-designed, controlled outcome studies are essential to scientifically demonstrate the safety and efficacy of their product.

By contrast, the CSG industry has not collected the very pre-drilling "baseline" health data that is essential if they are to demonstrate that their operations are safe. It is not up to the community to prove that CSG mining is harmful "beyond a reasonable doubt". The onus is on corporations that seek to profit from operating gas fields in populated areas to prove that their operations are safe.

The essential experiment that is needed to demonstrate the safety of the CSG industry would compare health data, taken before and after gas drilling commences, from a community exposed to CSG pollutants, with health data obtained from a similar community that is not exposed to CSG operations. No other experimental design is capable of approaching scientific "proof" that operating CSG gas fields in populated areas is safe.

The reports and studies cited by Mr Henderson in his 29 November 2013 letter provide useful scientific information, some of which is relevant to the CSG industry, but none of these documents include data obtained pre- and post-drilling, or from an appropriate control group. Consequently, none can provide scientific "proof" that the CSG industry is safe.

Nonetheless, the materials cited by Mr Henderson do provide scientific data that is relevant for the assessment of CSG-related health risks.

Following are brief reviews of what the AIP Health Watch program, the Queensland Government's CSG Health Report, AGL's Camden Northern Expansion Project EHIP, and the Public Health England Report, do and do not tell us about the safety of the CSG industry.

The Australian Institute of Petroleum (AIP) Health Watch Program

The AIP Health Watch program is a prospective cohort study of all-cause mortality and cancer incidence, and a case-control study of leukaemia and benzene exposure, for 20,000 past and current employees in the petroleum industry. The recently released, 14th Health Watch Report[12], provided an updated comparison of illness and cause of death statistics for petroleum industry employees compared with age-adjusted data for the Australian population. The study does not investigate acute health effects from working in the petroleum industry.

In his 29 November 2013 letter, Mr Henderson suggested that the AIP Health Watch program provided scientific evidence to support his claim that the CSG industry has been proven to be safe. Mr Henderson wrote:

> "The people most exposed to petroleum are healthy. The people probably most exposed to hydrocarbon gases and liquids, including substances such as BTEX which are naturally found in crude oil, are those who work in oil refineries and conventional natural gas processing plants. The AIP Health Watch program, which has been in operation since 1980 and is run by Monash University, shows that workers in the petroleum and natural gas production industry have better health than the general Australian community and are less likely to die of the diseases commonly causing death - including cancer, heart and respiratory conditions."

On a number, but not all, of the cancer and death statistics reported in the AIP Health Watch study, participating petroleum industry employees enjoyed better health outcomes than age-matched people in the general population. Nonetheless, this research does not indicate that working in the petroleum industry is either good or bad for your health - nor does it have any direct relevance to the question of whether the CSG industry is safe for workers and the public.

The AIP Health Watch study's "prospective cohort" design does not compare employees' pre-employment to post-employment changes in health with matched people in a control group. Consequently, the study can tell us some useful things about the health risks associated with working in the petroleum industry, but it cannot "prove" that working in the petroleum industry is safe or unsafe.

The 14th AIP Health Watch report is based on data obtained from petroleum industry employees who joined the study before the year 2000 and who had worked in the industry for five or more years. Consequently, there are likely to be few, if any, CSG industry employees contributing data to the study. Nonetheless, the research does provide some insights into the potential health risks of the CSG industry.

Throughout its history, the AIP Health Watch study has reported generally better health and mortality statistics for petroleum industry workers compared to age-adjusted figures for the Australian population. The Health Watch researchers attribute this result to the effects of a "selection bias" known as "The Healthy Worker Effect".

[12] The Australian Institute of Petroleum Health Surveillance Program (2013) Fourteenth Report, Monash University, November 2013.

As the Health Watch researchers explained:

> "One cause of the 'healthy worker effect' is the relative social and economic advantage of employed people, especially for people with relatively secure employment. Unemployed people as a whole tend to have lower socioeconomic status. This commonly correlates with lower income, fewer years of education, lower health status and higher age-adjusted mortality rates than employed people. Hence when the mortality of occupational cohorts is compared with that of the general population, the mortality rate is higher in the latter because it includes many socially disadvantaged people. Another factor is that people with life-threatening conditions, such as cancer, tend not to seek or obtain employment after diagnosis: this further lowers the mortality rate in the workforce compared with the general population, especially in the years immediately following recruitment of members of the cohort into Health Watch."[13]

The sample of subjects in the AIP study was further biased towards healthier people because:

- Data was only included after the employee worked for five years in the industry, thereby excluding people who left due to illness before they completed five years employment;
- The Health Watch participants had a low average lifetime tobacco use compared with the general population; and
- Prospective petroleum industry employees underwent health checks before they were employed.

Participants in the AIP study are likely to enjoy better cancer and mortality outcomes than the corresponding age group in the Australian population because they were selected from the beginning to be healthier than the average.

But does working in the petroleum industry have a beneficial, deleterious, or neutral effect on health?

According to the 14th AIP Health Watch report, when compared to the general population, for petroleum industry employees:

- "The chance of contracting cancer is similar for men and women … as for all Australians", but mortality from cancer is significantly reduced for male employees;
- "(For men) Two cancers, mesothelioma and melanoma, have been and are still occurring at statistically significantly higher rates than in the general population. Prostate cancer is also in statistically significant excess";
- "Prostate cancer incidence in the cohort is now statistically significantly higher than in the general population, however prostate cancer mortality remains similar to that of the general population";
- "There were 14 cases of melanoma in women. The incidence is slightly higher than in the general female population, but the increase is not statistically significant";
- "There were ten cases of lung cancer among women. This rate was slightly higher than the general female population….";
- "….This updated analysis now shows an almost identical risk of bladder cancer compared to the general population";

[13] The Australian Institute of Petroleum Health Surveillance Program (2007) 13th Report, Monash University, November 2013, Page 35.

- "There was a statistically significant lowering of lung cancer, liver cancer and cancers of the lip, oral cavity and pharynx and COPD which is probably a result of less tobacco consumption by members of the cohort than by the reference population";
- "Bladder and kidney cancers in the cohort remain similar to the general population, as does multiple myeloma";
- "Cancer mortality is also lower for men in all occupational groups investigated compared to the general population and is statistically so except for Terminal Operators and Maintenance workers";
- "Leukaemia, kidney and bladder cancers were also elevated in the driver group compared with office only workers but only statistically significantly so for bladder cancer"; and
- "The findings of this study (the case controlled study) provide strong evidence for an association between previous benzene exposure in the Australian petroleum industry and an increased risk of leukaemia."[14]

Given that the selection of participants in the AIP study was biased towards people who are healthier than average, findings that, relative to the general population, petroleum industry employees have: a similar chance of contracting cancer; a statistically significant increased incidence for men of mesothelioma, melanoma, and prostate cancer; and similar rates of bladder and kidney cancers, are causes for concern and warrant further investigation.

Due to its design, the AIP study cannot determine whether working for a minimum of five years in the petroleum industry is good or bad for an employee's health. It could well be that employees would have been healthier if they had not worked in the industry.

As the authors of the 14th AIP report noted:

> "There is an argument for using a reference population composed of workers with similar demographic characteristics including the likelihood of obtaining and retaining employment rather than the general population".

That is to say, the study needs a genuine control group, matched on relevant characteristics, to enable more informative analyses of the obtained results.

The AIP study provides some information about the health of petroleum industry employees, but tells us nothing about the health impacts of petroleum and gas industries on the general population. I note that, in this regard, in the USA, Lefall et al. (2010)[15] compared nationwide cancer mortality statistics with the incidence of cancer in three New York counties that had a distinctively rural character and a history of intensive gas and oil industry activity. Based on nation-wide statistics from 1950 to 1994 for 55 different types of cancer, women in these three counties were consistently in the top bracket for deaths caused by cancer of breast, cervix, colon, endocrine glands, larynx, ovary, rectum, uterus and vagina. Men from the same region were consistently in the highest statistical bracket for deaths caused by bladder, prostate, rectum, stomach, and thyroid cancers.[16]

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[14] Monash University and Deakin University (2001) Lympho-haematopoietic Cancer and Exposure to Benzene, in the Australian Petroleum Industry Technical Report and Appendices, June 2001.
[15] Leffall, L., Kripke, M. and Reuben, S. (2010). "Reducing Environmental Cancer Risk: What We Can Do Now"; *2008-2009 Annual Report of the President's Cancer Panel,* Part 2, Chapter 1, pp. 29 – 40, April 2010.
[16] National Cancer Institute (2011). Cancer Mortality Maps & Graphs, NIH, DHHS. http://www3.cancer.gov/atlasplus/type.html (January 2011).

AGL's Camden Northern Expansion Environmental Health Impact Assessment

In his 29 November 2013 letter Mr Henderson cited the AGL Camden EHIS[17] as evidence that the CSG industry has been proven to be safe. Specifically, Mr Henderson wrote that:

> "AGL's CSG project at Camden, on the outskirts of Sydney, has been operating safely for nearly 13 years with 144 wells drilled in the Macarthur Region."
>
> "We recommend that you take the time to read the huge amount of material that is available to the public in relation to the Queensland CSG projects and to AGL's recent Camden Northern Expansion Project Environmental Health Impact Assessment. AGL's study, which covers the full spread of potential health risks, concludes that its proposed Camden Northern Expansion would have posed low and acceptable risks to community health and to air, groundwater and surface water."

After studying AGL's EHIA, I could find no evidence there to support Mr Henderson's claim that AGL's CSG project at Camden "has been operating safely for nearly 13 years" or that the CSG industry has been proven to be safe.

I could find no health data in the AGL EHIA which compared the health status of local residents prior to, and following the setting up of AGL's gas fields in Camden, even though such data would be essential to establish the safety of the Camden CSG operation. I could not find any reference to any health data collected during 13 years of operations.

The AGL EHIA is "… a screening level health risk assessment that assesses the likelihood and severity of risks to human health."[18] That is to say, the AGL EHIA is not a real-world study of health impacts, and is not concerned with health data obtained from potentially affected people. The AGL EHIA is an assessment of risks in a possible future, and is based on certain assumptions, computer modelling and health guidelines, rather than real-life data.

As the authors of the AGL EHIA explained:

> "The EHIA presented in this report is a desk-top assessment. The term desk-top is used to describe that the EHIA has not involved the collection of any additional data over and above that which has been provided from Project specific EA technical studies, or studies undertaken for existing operations within the CGP or community consultation."[19]
>
> "The EHIA assessment presented in this report is largely qualitative, with some aspects addressed in a quantitative manner, and has been conducted for the purpose of summarising all the environmental health impacts that may be associated with the proposed Project, evaluating those impacts (on a qualitative or quantitative basis where relevant) and where an impact has been identified, determining if it can be mitigated through existing or other management measures."[20]

[17] Environmental Health Impact Assessment – Camden Northern Expansion Project, Prepared for AGL Energy Limited, 30 October 2013.
[18] Environmental Health Impact Assessment – Camden Northern Expansion Project, 30 October 2013, Page 1.
[19] Environmental Health Impact Assessment – Camden Northern Expansion Project, 30 October 2013, Page 3.
[20] Ibid.

The AGL EHIA does not include any controlled outcome study or data that could support the claim that CSG mining has been proven to be safe. The AGL EHIA can only support a claim that, on the basis of certain assumptions, in the opinion of the authors, there is a certain level of potential risk to human health.

Like other CSG risk assessments, the AGL EHIS assumes that gasfield industrialisation takes place in an ideal world, free of accidents, misadventure and negligence - where all works are carried out "in accordance with best practice, as well as the current policies and codes of practice".[21]

The limitations of such "desk-top" assessments as the AGL EHIA become apparent in the real world where, even with stringent regulation and best practice engineering, wells leak and 200 metres of bore pipe can be blown high into the air, CSG wastewater is dumped into rivers, and even AGL's risk assessment procedures can break down.

In March 2013 the NSW Environment Protection Authority (EPA) fined AGL for not maintaining its emissions monitoring equipment.[22] In the August 2013 "Undertaking to the Environment Protection Authority"[23], the EPA expressed "concern" that in 2007 AGL's emissions monitoring equipment began to break down, and by 2009 all their monitoring equipment had stopped operating.

AGL provided false information to the EPA in Annual Returns from 2006 to 2011, and its publicly available 2007 to 2011 Annual Environmental Performance Reports included the "false and misleading" statement that, "Full results of the continuous emissions monitoring for the reporting period are kept on file". "AGL advised that the non-reporting was due to oversight combined with a lack of understanding by AGL staff regarding the significance of the equipment breakdown".[24]

A serious limitation of CSG health impact risk assessments like the AGL EHIA and the Public Health England Report is their lack of health data obtained from people actually exposed to CSG operations, and their reliance on "guidelines" to determine the potential health risk posed by individual pollutants.

For many CSG pollutants, guidelines for safe levels of exposure do not exist, are inadequately researched, or only provide toxicity ratings which do not address all potential health impacts. For the compounds listed in AGL's EHIS Table 4.5 and "Report of Analysis" for air emissions (see Pages 6, 8&9 above) and Table 7.2 for waste water (see Pages 11&12 above), where available, "screening level guidelines" were derived from a variety of sources.

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[21] Environmental Health Impact Assessment – Camden Northern Expansion Project, Prepared for AGL Energy Limited 30 October 2013, Page 1.

[22] AGL Press Release (2013). AGL installs new continuous emissions monitoring equipment to satisfy EPA licence conditions, 13 March 2013. http://www.agl.com.au/about-agl/media-centre/article-list/2013/mar/agl-installs-new-continuous-emissions-monitoring-equipment-to-satisfy-epa-licence-conditions

[23] Gifford, M. (2013). Chief Environmental Regulator, NSW EPA, Protection of the Environment Operations Act 1997 (NSW) Undertaking to the Environment Protection Authority given for the purposes of Section 253A, AGL Upstream Investments Pty Limited, signed 8 August 2013. http://www.epa.nsw.gov.au/epamedia/EPAMedia13071501.htmhttp://www.epa.nsw.gov.au/resources/prpoeo/undertakingEPA0011.pdf

[24] Ibid.

As the authors of the AGL EHIS explained in Appendix 3 of their report:

> "It is noted that a number of chemicals have very limited data available and hence the studies available have been further evaluated for the purpose of determining the potential for adverse health effects to be of significance."[25]

> "It is noted that there are a number of chemicals where no suitable human health guidelines are available or relevant, hence the evaluation of these chemicals has been undertaken on a qualitative basis only."[26]

If "health guidelines" are to be used as criteria for ignoring the possible effect of a detected pollutant, then the validity, reliability and interpretation of guideline cut-off levels become vitally important.

In CSG health impact assessments such as the AGL EHIS, the ultimate conclusion that there is likely to be a minimal health impact from exposure to a large number of CSG pollutants newly introduced into an environment, is based on a procedure that only considers possible impacts of individual substances one at a time.

As the authors of the AGL EHIS explained the process:

> "Once an estimate of exposure has been developed it was compared to appropriate National or International health protective guidelines to determine if the Project poses a risk with regard to each of the hazards. If the exposure from the Project is less than the guideline then there is no unacceptable risk. If the exposure from the Project may be larger than the guideline there is potential for unacceptable risk which can be addressed by refining the worst case assumptions or by recommending control/ management measures be included in the Project."[27]

That is to say, in the AGL EHIA it is assumed that if any one of the many substances is present at a level below the adopted guideline cut-off point, then the health impact of that substance can be ignored. This process is based on the dubious assumption that there is no cumulative, interactive, or magnifying effects when people are exposed to a complex mix of dangerous substances that are poorly understood, and some of which can damage health even in minute doses.

The simultaneous exposure to numerous dangerous substances could present a greater risk to health than exposure to individual substances by themselves. While it might be safe to consume a particular substance at a dose of say $1/10^{th}$ of a recommended health guideline, the level of risk increases in an unknown manner when a number of substances are consumed even if each of them constitutes only a $1/10^{th}$ dose of a recommended guidelines dose.

[25] Environmental Health Impact Assessment – Camden Northern Expansion Project, Prepared for AGL Energy Limited 30 October 2013, Appendix C Human Health and Ecological Risk Assessment – Hydraulic Fracturing Activities, Page 22.
[26] Environmental Health Impact Assessment – Camden Northern Expansion Project, Prepared for AGL Energy Limited 30 October 2013, Appendix C Human Health and Ecological Risk Assessment – Hydraulic Fracturing Activities, Page 23.
[27] Environmental Health Impact Assessment – Camden Northern Expansion Project, Prepared for AGL Energy Limited 30 October 2013, Page 6.

The appropriateness and usefulness of this procedure is seriously undermined by the limited data and lack of guidelines for many chemicals, and the poor understanding of accumulative and synergistic effects that many of these chemicals and their metabolites can have on human physiological systems.

As US toxicologist Dr David Brown (2013)[28] explained, gas field toxicology is complicated because:

- We have incomplete identification of the chemicals present
- Chemicals can interact with other chemicals in complex unknown ways
- The presence of one agent can greatly increase the toxicity of another agent
- Agents have multiple physiological actions on various target organs
- Health effects of exposure to many chemicals is unknown
- How certain chemicals alter the biological processing of other chemicals is unknown
- Substances that inhibit metabolism or excretion magnify the effects of other chemicals
- Some agents can change the physiologic distribution of other chemicals
- Some agents can cause chemicals that would not normally do so to enter the brain
- Medications can affect the impact of toxic substances

The Public Health England Report on Health Impacts of Shale Gas Mining[29]

As recommended by Mr Henderson in his 29 November 2013 letter, I read the Public Health England (PHE) Report on the potential health impacts of shale gas mining in the UK, but could find nothing there to support Mr Henderson's claim that the CSG industry has been proven to be safe.

Like AGL's Camden EHIA, the PHE report is a "desktop" exercise in risk assessment, based on a particular set of assumptions, health guidelines applied to individual substances in a complex mix of pollutants, and a belief that regulation can ensure the safety of people who live amongst gas fields. The risk assessment design of the PHE report precludes it from providing scientific evidence to support the claim that the CSG industry has been proven to be safe.

I note that the authors of the PHE report concluded that, "Where potential risks have been identified in the literature, the reported problems are typically a result of operational failure and the poor regulatory environment", and UK regulations will "minimise the potential for pollution risk to human health."[30]

Significantly, the authors of the PHE report recommended that: a) "to facilitate the assessment of the impact of shale gas extraction on the environment and public health" the UK shale gas industry carry out the kind of baseline monitoring that is lacking in Australian CSG operations; and that b) "emission inventories", which already exist in Australia, be established to provide important information needed for proper assessment of health risks.

[28] Brown**,** D. (2013). Fundamental new Chemical Toxicology with Exposure Related to Shale Gas Development, Physicians Scientists & Engineers for Healthy Energy, http://www.psehealthyenergy.org/COURSES; http://www.youtube.com/watch?v=AhkswtBom4s

[29] Public Health England (2013) Review of the potential public health impacts of exposures to chemical and radioactive pollutants as a result of shale gas extraction, October 2013.

[30] Public Health England (2013) Review of the potential public health impacts of exposures to chemical and radioactive pollutants as a result of shale gas extraction, October 2013, Page iv.

The Queensland Government CSG Health Report[31]

In his 29 November 2013 letter, Mr Henderson cited the March 2013 Queensland Department of Health CSG Report as evidence that the CSG industry has been proved to be safe. As Mr Henderson wrote:

> "In March, 2013, the Queensland Government published a report which assessed health complaints from the Tara area and concluded that the available evidence does not support the concern among some residents that excessive exposure to emissions from CSG activities is the cause of the symptoms reported."

I note that the Queensland Department of Health report also concluded that the information it relied on from the Darling Downs Public Health Unit (DDPHU) investigation "did provide some evidence that might associate some of the residents' symptoms to exposures to airborne contaminants arising from CSG activities."

Like my recent report on the health impacts of CSG and shale gas mining[32], the Queensland Department of Health Report is an exercise in risk assessment based on the evaluation of available evidence that people have been exposed to CSG pollutants in doses sufficient to cause illness. Due to their design and the lack of any pre-drilling to post-drilling health data, neither investigation is capable of providing scientific "proof" that the CSG industry is or is not safe. Both reports can only generate probabilistic statements, based on specified evidence and assumptions, which assess the likely degree of risk to health.

The methodological, technical and analytical inadequacies of the Queensland CSG Health study have been discussed by Dr Geralyn McCarron[33] and Dr Mariann Lloyd-Smith[34], and the reader is directed to these papers for detailed analyses of this report.

My report on the health impacts of CSG and shale gas mining[35] and the Queensland Department of Health Report reached different conclusions regarding the probability of deleterious health impacts. Whereas the Queensland Department of Health report concluded that a "clear link" was not evident between the health complaints of some Tara residents and exposure to CSG pollutants, I concluded that there was a high probability of potentially catastrophic impacts from operating gas fields in populated areas.

In my opinion, the differing conclusions reached in my and the Queensland Department of Health assessments were due primarily to the different medical and environmental data that was available to, and used for, each report.

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[31] Queensland Department of Health (2013) Report on "Coal seam gas in the Tara region: Summary risk assessment of health complaints and environmental monitoring data", March 2013.
[32] Somerville, W. (2013) Self-help Risk Management Tools: A Report on the Health Impacts of CSG and Shale Gas Mining, download from the "CSG" page at www.creeksbend.com
[33] McCarron, G. (2013) Symptomology of a Gas Field: An Independent Health Survey in the Tara Rural Residential Estates and Environs. https://sites.google.com/site/frackingireland/symptomatology-of-a-gas-field
[34] Lloyd-Smith, Mariann (2013) No clean bill of health for CSG: A Critique of the Queensland Department of Health's Report on the Health Impacts of CSG Activities on the Tara Community, National Toxics Network.
[35] Somerville, W. (2013) Self-help Risk Management Tools: A Report on the Health Impacts of CSG and Shale Gas Mining, download from the "CSG" page at www.creeksbend.com

The Queensland Health Department risk assessment was based on:

- The Darling Downs Public Health Unit (DDPHU) investigation of 56 people who attended GPs and hospitals in the Tara region or who registered CSG related health complaints with a government phone service;
- A report by Dr Keith Adam based on "direct participation" with 15 people in person and two by telephone who attended clinics at Tara Hospital on 11–12 October 2012;
- Environmental Resources Management Australia Pty Ltd's (ERM) 13 air samples collected at nine residential sites in the Tara Estates from 11 to 19 July 2012; and
- Environmental monitoring from July-December 2012 at the Wieambilla Estates by Environmental Monitoring and Assessment Sciences.

My report on the health impacts of CSG and shale gas mining was based on information including:

- A review of the scientific literature on substances used, and liberated during, mining of gas from coal and shale seams;
- A review of the scientific literature on the contamination of air, water and soil systems by gasfield pollutants;
- A review of the scientific literature concerning the health impacts of exposure to CSG and shale gas pollutants;
- Dr Geralyn McCarron's (2013)[36,37] study on the health status of 113 people from 35 households in the Tara residential estates and the Kogan/Montrose region;
- CSG company reports to the 2013 Australian National Pollutants Inventory; and
- A 2013 medical test finding of a high level of hippuric acid, a metabolite produced following exposure to toluene, in the blood of a boy who lived in the Tara estates.[38]

As Dr Geralyn McCarron (2013) pointed out, the Queensland CSG health study did not consider the case of a boy whose blood tests indicated the presence of hippuric acid:

> "Toluene metabolites found at high levels in a child in a non-occupational context is worrying, taking into account the short half-life i.e. toluene is quickly metabolised. This should have prompted investigation by the health department as a matter of urgency. Toluene is a known neurotoxin, an irritant and a suspected reproductive toxin that can be absorbed via inhalation. It is known to be associated with coal seam gas and has been found repeatedly in air samples in the residential estates. No action was taken by the health department."[39]

The Queensland CSG Health study relied on face-to-face interactions with 71 people, while my study referred to Dr Geralyn McCarron's (2013) survey of 113 people in the Tara area.

[36] McCarron, G. (2013). Symptomology of a Gas Field: An Independent Health Survey in the Tara Rural Residential Estates and Environs, Page 29.
[37] McCarron, G. (2013). Submission to the NSW Chief Scientist and Engineer's review of coal seam gas activities in NSW with a focus on the impacts of these activities on human health and the environment. http://www.chiefscientist.nsw.gov.au/coal-seam-gas-review/?a=30015
[38] McCarthy, J. (2013). Testing Times ahead for residents of Tara as boy found with hippuric acid in system, Sunday Mail QLD, 6 January 2013.
[39] McCarron, G. (2013). Symptomology of a Gas Field: An Independent Health Survey in the Tara Rural Residential Estates and Environs. https://sites.google.com/site/frackingireland/symptomatology-of-a-gas-field

Another difference between my report on the health impacts of gas mining and the Queensland CSG Health Study was the data used to evaluate the likelihood that people who live near gas fields are being exposed to pollutants in sufficient doses to cause illness.

The Queensland CSG Health investigation relied on a limited number of potentially biased air samples. In the Queensland health study residents were instructed to take canister air samples when they smelled odours. This procedure was likely to bias results towards more samples being taken during the daytime, rather than at night when people were more likely to be indoors and pollutant levels are generally higher. The Queensland health study assumed that sampling when odours were present would guarantee that samples were taken when problematic pollution was at a maximum concentration, even though there are no grounds for assuming that the presence of the most dangerous pollutants is associated with odours.

By contrast, my assessment of potential health impacts from exposure to gas field pollutants also took account of recently available data from the Australian National Pollutant Inventory (ANPI) as well as from environmental sampling of air and water.

It was notable that data presented in the Queensland Health Study and the AGL Camden EHIS demonstrate a wide range of results when environmental testing involves multiple air or water samples obtained from the one site. For example, in the Queensland Health study benzene readings from one site varied from <4.3 $\mu g/m^3$ in the daytime to 25 $\mu g/m_3$ at night. The wide variation in results indicates that adequate assessment of CSG pollution requires continuous sampling over extended periods of time to take into account fluctuations due to such factors as time of day, weather conditions, and season.

As the authors of the Queensland Health study commented:

> "However, the air monitoring program had important limitations. The total monitoring period was nine days, the methodology resulted in limits of reporting for some analytes that were substantially higher than reference air quality criteria and the monitoring was not designed to identify short-term peaks or troughs in air concentrations. It is considered a more strategic air quality monitoring program could be implemented to provide more useful information on the impacts of the CSG industry, if any, on ambient air quality in the region."

The problems inherent in the use of "guidelines" to evaluate the potential health impacts of exposure to a complex mix of pollutants by considering each pollutant one at a time have been discussed above in relation to the AGL Camden EHIS.

The combined health effects of simultaneous exposure to many pollutants, even if each is present in concentrations below a chosen "standard", is entirely unknown. This issue is especially important for interpreting the Queensland CSG Health report because testing of air samples over brief periods of time in a residential estate in Tara detected a diverse range of compounds including the VOCs hexane, propene, chloromethane, dichlorodifluromethane, methylene chloride, ethanol, acetone, methyl ethyl ketone, acrolein, vinyl acetate, pentane, heptane, tetradecane, hexadecane, heptadecane, cyclohexane, 2-methylbutane, 3-methylpentane, 3-methylhexane, methylcyclohexane, tetrachloroethylene, 2-ethyl-1-hexanol, ethylacetate, benzene, toluene, xylene, ethylbenzene, 1,2,4-trimethylbenzene, phenol, benzothiazole, naphthalene, and alpha-pinene.[40]

[40] National Toxics Network (2013). No clean bill of health for CSG: A Critique of the Queensland Department of Health's Report on the Health Impacts of CSG Activities on the Tara Community, April 2013. www.ntn.org.au

While environmental sampling can evaluate the presence of CSG pollutants at a particular place and time, the Australian National Pollutant Inventory (ANPI) contributes to the assessment of the risk of human contamination by providing data that quantifies the overall volume of pollutants that gas mining companies release each year into the atmosphere and local environments.

For instance, from the National Pollutant Inventory data we know that during 2011/2012:

- Arrow Energy's Daandine Gas Field released into the air substances including 140,000 kg of Carbon monoxide, 13,000 kg of Formaldehyde, 210,000 kg of Oxides of Nitrogen, 13,073 kilograms of Particulate Matter, and 30,000 kg of Volatile Organic Compounds (VOCs); and

- QGC's Kenya CSG processing plant and compressor station in Tara released into the air 520,000 kg of carbon monoxide, 47,000 kg of formaldehyde, 840,000 kg of oxides of nitrogen, 5400 kg of Particulate Matter, 17,000 kg of fluoride compounds, 110,000 kg of VOCs, while 17,000 kg of waste was in long-term on-site storage.

The National Pollutant Inventory data makes it possible to estimate the scale of the total load of air pollutants that are discharged into local environments by specific CSG operations such as gas fields and compressor and processing plants. The CSG industry is being massively expanded in Queensland - QGC estimate that they will have 24 CSG compressor/processing plants operating by the end of 2014 - and National Pollutant Inventory data enables informed estimates of the environmental pollution that will be produced when these gas fields are fully developed.

As well as discharges into the air, the total environmental burden of pollutants from CSG operations includes air, water, and soil contamination from drilling chemicals and muds, flared and vented gases, fugitive emissions, evaporations from waste water ponds, produced water from coal seams, and substances removed by filtration.

Once the total environmental burden of pollutants is known, the scientific task is to determine the ability of local soil, water, and air systems to dissipate, process, and render inert the known quantities of persistent, bio-accumulative, teratogenic, mutagenic, carcinogenic, endocrine-disrupting, and toxic substances that will be regularly discharged into the local environment, often within earshot of where people live. Such empirical analyses could then inform debate about whether operating industrialised gas fields in populated areas constitutes a minimal or, as I argue, a high level risk of potentially catastrophic health impacts.

In his letter of 29 November 2013 Mr Henderson cited a comment about employee health from the Queensland Government report as support for his claim that CSG has been proved to be safe. Mr Henderson wrote:

> "To quote from the Darling Downs Public Health Unit report, one of the reasons for dismissing a link between CSG and reported health problems is '*the lack of evidence of employees working within the CSG industry having similar symptoms. If community members were experiencing symptoms due to CSG activities, it would be highly likely for workers in the industry to be reporting similar and probably more severe effects due to their likely much higher exposure'".* (Italics in original)

In this "worker good health" argument, the validity of the conclusion depends on the truth of the supporting premises. This argument takes the form:

- Premise 1 - Workers have a much greater exposure to CSG pollutants than the public,
- Premise 2 - There is no evidence that CSG workers experience symptoms,
- Conclusion - Therefore, there is no link between exposure to CSG pollutants and symptoms reported by the public.

The first premise - that CSG workers have a much greater exposure to pollutants than residents who live amongst gas fields - might appear reasonable, but is not necessarily true. The Queensland CSG Health study does not cite any scientific research that compares the exposure to pollutants of local residents, and especially of children, who live amongst the gas fields 24 hours a day, seven days a week, with the exposure of workers selected to be of good health, who work shifts, often on a fly-in/fly-out basis, and who have access to worker health and safety training and protective equipment.

The second premise - that there is no evidence that CSG workers experience symptoms - begs the question as to whether this lack of evidence indicates that workers truly are not experiencing health problems, or that their health problems are not being reported, or are being reported to their family doctors rather than to their employers' medical personnel.

As Dr Penny Hutchinson, author of the Darling Downs Public Health Unit Investigation in the Queensland Health Report, commented:

> "Similarly there have been no reported presentations by employees of the mining companies with symptom patterns similar to those described by the residents. There are multiple potential reasons for this including:
>
> - the employees are not experiencing symptoms,
> - employees are presenting to health-care providers outside the local area (many mining employees work fly in/fly out or drive in/drive out rosters so they leave the local area and return to their usual place of residents between working shifts),
> - employee concerns that if they report similar symptoms to those in the community it may jeopardise their employment."[41]

I note that there is anecdotal evidence that CSG industry workers have experienced health problems similar to those reported by Tara residents. In her 2013 report, Dr Geralyn McCarron observed that:

> "Of the 113 people surveyed, 4 worked in the CSG industry. Two of these were involved in infrastructure construction and although both had ongoing skin irritation, neither believed their health was impacted. One person, after 4 months employment in a CSG facility, began to develop severe symptoms in their hands and feet. After biopsy they were eventually diagnosed with neuropathy (nerve damage) and can no longer work. The fourth worker also has a symptomatic neuropathy which has been, without tests, diagnosed as carpal tunnel. They also suffer from severe fatigue, headaches and nausea."[42]

[41] Hutchinson, P. (2013) The Darling Downs Public Health Unit Investigation into the health complaints relating to Coal Seam Gas Activity from residents residing within the Wieambilla Estates, Tara, Queensland, July to November 2012, FINAL REPORT, January 2013.

Dr Geralyn McCarron further reported that:

> "Following the publication of the Queensland Government's health report and Lawrence Springborg's assertion that CSG workers have had no health problems, a person previously employed on CSG drilling rigs in a different area of Queensland was so disgusted that they contacted the Gasfields Support Group to relate their story. That data is not included in the numbers for this study. This worker's ill health included nosebleeds, spasms of the hands and extreme difficulty breathing, making it impossible to continue work. Their comment was: *"They wiped their hands of me."*[43] (Italics in original)

Mr Henderson's 29 November 2013 letter included an unfortunate reference to the Queensland CSG Health study to support his claim that the CSG industry has been proved to be safe. Mr Henderson wrote that:

> "The Queensland Government report highlighted concerns with Tara drinking water because it was contaminated by faecal matter, not hydrocarbons."

Mr Henderson's statement is problematic because the association of "faecal matter" with "drinking water" is likely to create a degree of disgust in the reader, and this emotion contributes to the potency of the implications that the statement carries about the hygiene of the Tara residents and the causes of their medical problems. Further, Mr Henderson's statement benefits from the authority of the Queensland Government but, in my opinion, does not properly represent the findings of the Queensland CSG Health study.

In regards to sampling of water, the Queensland Health CSG Report noted:

> "Samples were collected from potable drinking water sources (all nine lots) and ponds and surface water sites (five lots)… According to the ERM report, all properties reported use of roof-harvested water for drinking and most household purposes. Two properties reported use of on-site ponds or surface water created by a dam for washing and bathing."[44]
>
> "Two rainwater tanks were reported to contain E.coli, but all tanks had some type of microbial contamination as demonstrated by the other testing. The presence of microbes is expected in both roof-harvested water and untreated surface water. Further microbial analysis would be needed to identify potential health hazards."[45]

As noted in the Queensland Health CSG report, the presence of microbes in roof harvested water used for drinking is nothing unusual for rural areas. In my opinion, the finding of E.coli in two rainwater tanks does not justify Mr Henderson's claim that the Queensland Government report "highlighted concerns with Tara drinking water because it was contaminated by faecal matter, not hydrocarbons".

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[42] McCarron, G. (2013). Symptomology of a Gas Field: An Independent Health Survey in the Tara Rural Residential Estates and Environs, Page 27.
[43] McCarron, G. (2013). Symptomology of a Gas Field: An Independent Health Survey in the Tara Rural Residential Estates and Environs, Page 28.
[44] Queensland Department of Health (2013) Report on "Coal seam gas in the Tara region: Summary risk assessment of health complaints and environmental monitoring data", March 2013, Page 10.
[45] Queensland Department of Health (2013) Report on "Coal seam gas in the Tara region: Summary risk assessment of health complaints and environmental monitoring data", March 2013, Page 11.

Discussion, Implications and Recommendations

After attending Mr Peter Henderson's presentation at the 14 November 2013 meeting with Kyogle's Mayor, I understand why some local government councillors and business people, who have the community's best interests at heart, could support Mr Henderson's plans for the gas field industrialisation of the Northern Rivers.

Mr Henderson's account of what the CSG industry offers the Northern Rivers is very attractive – a proven safe, "clean and green" development with no downside, and economic benefits with no costs. And the Northern Rivers is special because our coal seams do not contain benzene, and the gas and CSG waste water are safe to use straight out of the ground.

For gas industry executives and employees, and others looking to profit from gas mining, Mr Henderson's claims that the CSG industry is in all ways safe and beneficial have potent commercial implications. The costs involved in meeting legal obligations to manage risk are greatly reduced - if there is no risk there is nothing to manage. When there is no danger, government regulations to protect health and the environment become unnecessary.

If members of local councils and regulatory authorities believe that local CSG wastewater is safe for use with minimal processing, then "a problem becomes a product". The issue of how to safely dispose of CSG wastewater disappears because the water can be sold as fit for human and agricultural use.

Mr Henderson's claims about the safety of the CSG industry and the nature of coal seam gas and waste water in the Northern Rivers were presented as facts about the real world, and are therefore testable by empirical evidence and rational argument.

In my opinion, Mr Henderson has not provided any direct or credible evidence that:

- CSG compressor and processing plants in the Northern Rivers would not create the pollution seen in Queensland gas fields;
- The CSG industry is proven safe;
- Northern Rivers CSG does not contain any impurities;
- There is no benzene in coal seams; and
- Metgasco's CSG waste water is fit, without treatment, for use with stock, and with the removal of some salt, suitable for irrigation and human consumption.

In his letter, Mr Henderson stated that, "Communities deserve sensible and open debate about the best ways to achieve our energy needs and balance any potentially competing interests".

To progress this "sensible and open debate", in my opinion, it would be useful if Mr Henderson made public chemical assays, with detail similar to the assays provided by AGL in their Camden EHIS, to support his claims about the nature and safety of CSG operations in the Northern Rivers.

In his letter Mr Henderson wrote, "Your exaggerated and incorrect comments do nothing to encourage such debate. They do no more than create unjustified fear."

Everyone prefers good news to bad, but when difficult issues have to be confronted, it is sometimes better to be anxious now than sick and sorry later.

Anxiety is a natural protective emotion that operates to warn us of the presence of danger. Anxiety that works well motivates people to take action to reduce the risk of harm. For the first time, heavily industrialised gas fields are being established where people live, work, and raise children, and the implications for community health are profound. The community confronts a potential health crisis reminiscent of that created by the asbestos industry.

In the 1930s it was known that asbestos caused cancer, but the industry thrived with government support until it was banned in 2003. Profits reaped over decades were never discounted to reflect the true costs in suffering, illness and death borne by the community. Today, asbestos is widely distributed throughout the environment and will continue to be a health hazard into the future.

Gas field industrialisation of the Northern Rivers has the potential to produce dangerous pollution that will impact on health for generations to come. In the interests of protecting community health, there is an urgent need for an expanded public debate on the safety of the industry.

On the basis of the scientific evidence detailed in my report on the health impacts of CSG and shale gas mining[46], I concluded that there is a high probability of potentially catastrophic health impact from operating gas fields in populated areas. In my opinion, there is nothing in Mr Henderson's letter that contradicts my conclusion, and there is much in the references he cites to support my assessment.

Democracy and the giving of informed consent depend on citizens and their political representatives having access to accurate evidence-based information. Citizens are entitled to express their opinions and beliefs but, in my opinion, claims about the safety of the CSG industry that purport to be factual need to be supported by scientific evidence.

Mr Henderson received a pre-publication copy of this paper and was invited to provide a response which would be attached to the document when it was made public. Mr Henderson was also asked if he would be willing to participate in further public discussion about the potential health impacts of operating gas fields in populated areas.

In a letter dated 24 January 2014, Mr Henderson responded to my analysis of the arguments and scientific evidence that he presented in his 29 November 2013 letter. Mr Henderson declined the invitation to further debate CSG health impacts. Mr Henderson's 24 January 2014 letter is attached to this paper as Appendix B.

[46] Dr Wayne Somerville (2013) Self-help Risk Management Tools: A Report on the Health Impacts of CSG and Shale Gas Mining, download from the "CSG" page at www.creeksbend.com

Mr Henderson's Parting Statements

In my opinion, in his 24 January 2014 letter Mr Henderson did not provide any relevant scientific evidence or reasoned argument to support his claims that: the CSG industry is proven to be safe; local CSG and CSG waste water contain no dangerous substances and are fit for human, animal and agricultural use with minimal to no processing; and that the CSG industry in the Northern Rivers would involve none of the documented pollution produced by CSG operations in Queensland.

Rather, Mr Henderson provided debatable statements of personal opinion. For instance, Mr Henderson wrote:

> "As a final comment, we note that your paper refers to the "healthy worker effect" and the association between unemployment and lower health status and higher mortality rates. If you are genuinely interested in the health of the Northern Rivers people, shouldn't you be promoting an industry that provides secure employment and income security for landholders? Surely, job security, supplementary income for farmers and a reliable energy supply go a long way to reducing stress, more than offsetting any discomfort associated with change."

My concerns go well beyond being "interested in the health of the Northern Rivers people". I have lived in the Northern Rivers most of my life - raising a family and working as a farmer and as a health professional. I know that this region "abounds in nature's gifts of beauty rich and rare" and, for good reasons, I strongly believe that, if protected, our natural resources of sweet water, clean air, and healthy communities will ensure the prosperity of this region for generations to come.

I do not believe that the coal seam gas industry can provide "secure employment and income security for landholders". Short-term construction jobs and limited payments to farmers will not offset the loss of land values and the long-term economic damage done to agricultural, tourism, residential, and other industries that otherwise have a bright future in this area.

The stress from being forced to live and raise families amongst gas fields is not mere "discomfort associated with change". "Change" is not desirable in itself - it can be good or bad, depending on what is lost and what is gained. For most citizens, the change brought about by gasfield industrialisation would result in profound personal, social, and economic losses. Imposing the CSG industry on rural communities is a radical experiment in social and environmental engineering that violates the conservative principle of protecting that which already exists and is truly precious.

In his 24 January 2014 letter, Mr Henderson stated:

> "More importantly, you continue to maintain an alarmist position when you conclude that 'there is high probability of potentially catastrophic health impacts for operating gas fields in populated areas'. This position has no credibility whatsoever."
>
> "By inspection, any reasonable person can look at the data and conclude that there is no substance to your position. Apart from the succinct response we made to your first paper, please note that:

> " The oil and gas industry has operated on a large scale all around the world for more than 100 years – it is not new or unusual.
> In the USA there are currently more than 1,000,000 producing oil and gas wells. These wells produce the full range of hydrocarbons (oil and gas), not just methane. (Our CSG wells produce essentially just methane. Methane is not toxic. It occurs naturally and is also produced from compost bins and cows. People are exposed to it as part of their everyday lives.)
> These USA oil and gas wells have been drilled in rural areas and in areas much more highly populated than the exploration licences we have in the Northern Rivers region."

Regarding Mr Henderson's statements, I note that:

- Mr Henderson's "response" in his 29 November 2013 letter may have been "succinct" (i.e., expressed in few words) but, in my opinion, it failed to provide any credible scientific evidence to support his claims about the "proven safety" of the CSG industry, or the pure quality of CSG and CSG waste water in the Northern Rivers;

- The oil and gas industry may have operated "all around the world for more than 100 years", and there may be more than 1 million producing oil and gas wells in the US, but the development of unconventional gas fields involving thousands of wells across extensive areas of populated, previously rural countryside, is a recent phenomenon;

- Breathing methane in low doses may not be toxic, even though the health effects are unknown, but the dangerous substances liberated, used, and produced by the CSG industry constitute a real and serious threat to human health;

- Denying the existence of scientific evidence which indicates a high level risk of potentially catastrophic health impacts from operating gas fields in populated areas, does not mean that the industry is safe - ignoring the science does not make the danger go away.

In his 24 January 2014 letter, Mr Henderson stated:

> "Where is the catastrophic health impact associated with all these USA wells? The answer is that there is no catastrophic health impact. A similar review of the 4000 CSG wells drilled in Queensland over the past 20 years also shows that there is no health concern."

The answer to Mr Henderson's question, "Where is the catastrophic health impact", is to be found in the rapidly growing body of research that documents the health impacts of living near gas fields. The full extent and severity of the health impact will become evident in the health status of children conceived and born in gas fields, who develop while being exposed to gasfield pollutants, and who mature to have families of their own.

For example, a recently published study by Kassotis, Tillitt, Davis, Hormann, and Nagel (2013)[47] found a strong association between unconventional gas mining and the presence of endocrine-disrupting chemicals (EDCs) in water systems used for human consumption.

[47] Kassotis, C.D., Tillitt, D.E., Davis, J.W., Hormann, A.M., and Nagel, S.C. (2013) Estrogen and Androgen Receptor Activities of Hydraulic Fracturing Chemicals and Surface and Ground Water in a Drilling-Dense Region, *Endocrinology*, endo.endojournals.org, doi: 10.1210/en.2013-1697.

Kassotis et al (2013) found that water samples taken from drilling sites within a 10,000 well gas field in Garfield County, Colorado, as well as the Colorado River which takes run-off from the gas field, showed moderate to high levels of endocrine-disrupting chemical (EDC) activity, while samples from sites in Colorado and Missouri with little drilling showed little EDC activity.

About 100 chemicals used in gas mining are known or suspected to be endocrine-disrupting. The researchers reported, for the first time, estrogenic, anti-estrogenic, and anti-androgenic activity in a subset of 12 chemicals used in natural gas operations (i.e., ethylene glycol monobutyl ether, 2-ethylhexanol, ethylene glycol, diethanolamine, diethylene glycol methyl ether, sodium tetraborate decahydrate, 1,2-bromo-2-nitropropane-1,3-diol, n,n-dimethyl formamide, cumene, styrene, bronopol and naphthalene). One of the twelve chemicals exhibited estrogenic activity, eleven had anti-estrogenic activity, and ten had anti-androgenic activity.

Research indicates that exposure to EDCs increases the risk of reproductive, metabolic, neurological, and other diseases, especially in children, by interfering with the body's response to the reproductive hormones estrogen and testosterone. Research has linked EDC exposure to infertility (decreased sperm quality and quantity), impaired gonadal development (including undescended testis), reproductive tract deformities (including hypospadias - a congenital defect in which the urinary meatus is on the underside of the penis), cancer, and birth defects (including decreased anogenital distance).

Kassotis et al (2013)[48] noted that a particular concern with exposure to EDCs is the potential for additive effects of mixtures of chemicals that act through a common biological pathway, even when each chemical in the mixture is present at levels below an observed effect threshold.[49] Laboratory experiments have shown a wide range of effects at environmentally relevant, low concentrations that were not predicted by traditional risk assessments from high-dose testing. EDCs may be of particular concern during critical windows of child development when exposure can alter normal development.

In his 24 January 2014 letter, Mr Henderson brought to an end our discussion on CSG health impacts in the following manner:

> "NSW has a plethora of approval processes and regulations that Metgasco and other gas exploration and production companies must comply with if we are to explore and develop gas."
>
> "The processes and regulations allow and promote community participation and awareness and are designed to ensure that health, safety and environmental risks are managed acceptably. We will continue to work within this approval and regulatory environment. We are also committed to transparency and community consultation and will continue to discuss safety, health and environment issues accordingly. We are not, however, willing to participate in the poorly managed public discussions that have occurred in the Northern Rivers over recent years. Instead, we ask you to respect the

[48] Kassotis, C.D., Tillitt, D.E., Davis, J.W., Hormann, A.M., and Nagel, S.C. (2013) Estrogen and Androgen Receptor Activities of Hydraulic Fracturing Chemicals and Surface and Ground Water in a Drilling-Dense Region, *Endocrinology*, endo.endojournals.org, doi: 10.1210/en.2013-1697.

[49] Silva E, Rajapakse N, Kortenkamp A. Something from "nothing"– eight weak estrogenic chemicals combined at concentrations below NOECs produce significant mixture effects. *Environmental Science,Technology*. 2002;36(8):1751–1756.

> approval and regulatory processes that exist and to participate in the associated review processes. If you are not happy with them you should approach the relevant NSW government ministers and justify changes to the processes and regulations."

That is to say, Mr Henderson and Metgasco are "committed to transparency and community consultation and will continue to discuss safety, health and environment issues", but only within the Government's "approval and regulatory environment", and not via participation in "poorly managed public discussions" in the Northern Rivers.

And so this CSG health debate ended before it got very far.

Mr Henderson indicated that he will not engage in further public discussion of the scientific "evidence" that he says he has to support the claims about the safety of the CSG industry he made to Kyogle's Mayor. Instead, Mr Henderson recommended that I "participate in the associated review processes" and take any grievances that I might have to the relevant Minister.

As detailed above, in my opinion, Mr Henderson has provided no credible scientific evidence to support his claims that the CSG industry has been "proven" to be safe, or that local CSG and CSG waste water contain no benzene or any other dangerous substances, and are fit for human, animal and agricultural use with minimal processing. I do not know why Mr Henderson claimed that CSG compressor stations and processing plants in the Northern Rivers would not produce the documented pollution created by CSG processing in Queensland. I do not understand why Mr Henderson believes that Northern Rivers' gas, wastewater, and CSG processing are uniquely "clean" with no potential to pollute.

Mr Henderson has not retracted any of his specific claims about the safety of the CSG industry in the Northern Rivers. It seems reasonable to expect that he could repeat these claims in the future while promoting his business.

As I understand Mr Henderson's position, his compliance with a "plethora of approval processes and regulations" satisfies his obligations to provide evidence for his claims about the safety of local CSG operations.

Consequently, the Northern Rivers community will have to rely on the NSW Government to provide the scientific evidence that justifies the claims about safety that Mr Henderson presented as fact while promoting his CSG business to Kyogle's Mayor.

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Appendix A

METGASCO

29 November 2013

Dr Wayne Somerville
Clinical Psychologist
PO Box 744
Kyogle, NSW 2474

Cc: Councillor Danielle Mulholland, Mayor - clrdanielle.mulholland@kyogle.nsw.gov.au

Dear Dr Somerville,

NSW and Northern Rivers residents need energy for heating, lighting and cooking in their homes and to power domestic appliances. We all need transport fuels and in the work place our jobs depend on reliable energy supplies to power equipment and to provide heating and cooling. Our lives depend on reliable energy supplies.

Natural gas from coal seams currently meets a third of eastern Australia's gas supply needs and our industry has a proven and safe track record over a number of decades.
Exports of natural gas from Australia are helping less developed countries to reduce the extent of air pollution and associated illness.

Communities deserve sensible and open debate about the best ways to achieve our energy needs and balance any potentially competing interests. Your exaggerated and incorrect comments do nothing to encourage such debate. They do no more than create unjustified fear.

Contrary to points you have previously raised, the safety of CSG and the broader oil and gas industry has been examined and demonstrated.

- **Methane is not toxic** As any science student knows, methane, the major component of coal seam gas, is a colourless, odourless gas and is not toxic. It is used for heating every day in hundreds of thousands of homes and in thousands of industries, without adverse health impacts. Methane is also produced naturally from many sources including compost heaps and cattle. Methane gas seeps naturally from the ground. People have been exposed to coal and hence coal seam gas for centuries. It has been liberated in considerable quantities from coal mines. This is not new.

- **Our coal seam gas is almost pure methane** The natural gas we produce from our coal seams is about 98% methane, with very small amounts of ethane (another colourless, odourless and non-toxic hydrocarbon gas), carbon dioxide and nitrogen. Gas chromatograph data for our coal seam gas shows virtually no hydrocarbons heavier than ethane. By inspection, there is absolutely no reason for concern in terms of metals, volatile organics or BTEX chemicals. For your information, the gas we found in our Kingfisher exploration well (a conventional gas field) has a similar composition to our CSG. It has a little more ethane and propane than our CSG but gas chromatograph data shows hydrocarbons no heavier than pentane and, again by inspection, provides no reason for concern.

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Our coal seam gas meets specifications for sales gas, it does not need to be treated to be sold into the gas market. It might need to have small quantities of water removed to be distributed in a large pipeline system.

Our gas quality data is consistent with measurements of CSG water quality. A thorough analysis of our CSG produced water shows that it meets Australian Drinking Water Guidelines, apart from its salt levels, which are about 1/10 of the level in sea water. Bioassay (acute toxicity) testing has provided further and broader confirmation that the CSG water is not toxic. We have a range of studies to demonstrate that our water, after some salt removal, is suitable for irrigation. It is suitable for stock watering, even without salt removal.

Should you wish to explore the wealth of data that is available on websites you will find that gas produced from other Australian coal seams is also primarily methane, with very low concentrations of any hydrocarbons heavier than ethane. For example, we draw your attention to AGL's Environmental Health Impact Assessment – Camden Northern Expansion Project, 30 October, 2013, provides further information to support high methane levels and correspondingly low levels of heavier hydrocarbons in its gas. Again, by inspection, there is no reason for concern about volatile organic compounds, BTEX or metals. This information can be found on the AGL website.

Your comment "*When we export coal we do so with its impurities. But with gas the impurities are taken out here and they are dumped on the environment and the local community"* is simply incorrect and unnecessarily alarmist. The air emissions you quote for Queensland CSG operations are mainly from engine exhausts, no different in nature from any other engine exhausts, including cars, tractors and farm equipment. The emissions are not "impurities" removed from the gas.

- **The people most exposed to petroleum are healthy**

  The people probably most exposed to hydrocarbon gases and liquids, including substances such as BTEX which are naturally found in crude oil, are those who work in oil refineries and conventional natural gas processing plants. The AIP Health Watch program, which has been in operation since 1980 and is run by Monash University, shows that workers in the petroleum and natural gas production industry have better health than the general Australian community and are less likely to die of the diseases commonly causing death - including cancer, heart and respiratory conditions. You can find more about this at:

  http://www.aip.com.au/health/ohs.htm

  The following Queensland Government website provides details about BTEX exposure sources and levels.

  http://www.ehp.qld.gov.au/management/non-mining/btex-chemicals.html

- **CSG has operated in Australia for nearly 20 years without health problems** AGL's CSG project at Camden, on the outskirts of Sydney, has been operating safely for nearly 13 years with 144 wells drilled in the Macarthur Region.

  CSG in Australia has operated in Australia for nearly 20 years, without any health concerns. There are now about 4000 wells drilled, without health concerns.

  In March, 2013, the Queensland Government published a report which assessed health complaints from the Tara area and concluded that the available evidence does not support the concern among some residents that excessive exposure to emissions from CSG activities is the

cause of the symptoms reported. To quote from the Darling Downs Public Health Unit report, one of the reasons for dismissing a link between CSG and reported health problems is

> "*the lack of evidence of employees working within the CSG industry having similar symptoms. If community members were experiencing symptoms due to CSG activities, it would be highly likely for workers in the industry to be reporting similar and probably more severe effects due to their likely much higher exposure."*

The Queensland Government report highlighted concerns with Tara drinking water because it was contaminated by faecal matter, not hydrocarbons.

- **The industry is heavily regulated and there are numerous studies to demonstrate health and safety**

  The CSG and petroleum industry is heavily regulated and must pass stringent health, safety and environmental checks before developments can proceed.

  There are numerous studies available to show that CSG operations represent a low health risk to the community. We recommend that you take the time to read the huge amount of material that is available to the public in relation to the Queensland CSG projects and to AGL's recent Camden Northern Expansion Project Environmental Health Impact Assessment. AGL's study, which covers the full spread of potential health risks, concludes that its proposed Camden Northern Expansion would have posed low and acceptable risks to community health and to air, groundwater and surface water. You should also be aware of the recent Public Health England report which found that shale gas extraction emissions are a low to risk to public health.

Dr Somerville, the comments you have made in the media and in your report "CSG and Your Health" demonstrate that you have little understanding of the CSG industry and the technical and safety issues involved. Your comments about catastrophic health impacts do nothing for your credibility.

The community deserves intelligent, informed debate, not alarmist comments.

Yours sincerely

Peter J Henderson
Managing Director and CEO

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Appendix B

METGASCO

24 January 2014

Dr Wayne Somerville
Clinical Psychologist
P.O. Box 744
Kyogle, NSW 2474

Dear Dr Somerville,

Thank you for the opportunity to read your latest paper (Is CSG safe, A Public Debate in the Interests of Community Health) and comment.

We are disappointed that you continue to exhibit a poor understanding of the petroleum industry and the approval and regulatory processes that we must comply with. More importantly, you continue to maintain an alarmist position when you conclude that “there is high probability of potentially catastrophic health impacts for operating gas fields in populated areas”. This position has no credibility whatsoever.

By inspection, any reasonable person can look at the data and conclude that there is no substance to your position. Apart from the succinct response we made to your first paper, please note that:

 The oil and gas industry has operated on a large scale all around the world for more than 100 years – it is not new or unusual.

 In the USA there are currently more than 1,000,000 producing oil and gas wells. These wells produce the full range of hydrocarbons (oil and gas), not just methane. {Our CSG wells produce essentially just methane. Methane is not toxic. It occurs naturally and is also produced from compost bins and cows. People are exposed to it as part of their everyday lives.}

 These USA oil and gas wells have been drilled in rural areas and in areas much more highly populated than the exploration licences we have in the Northern Rivers region.

Where is the catastrophic health impact associated with all these USA wells? The answer is that there is no catastrophic health impact.

A similar review of the 4000 CSG wells drilled in Queensland over the past 20 years also shows that there is no health concern.

NSW has a plethora of approval processes and regulations that Metgasco and other gas exploration and production companies must comply with if we are to explore and develop gas.

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The processes and regulations allow and promote community participation and awareness and are designed to ensure that health, safety and environmental risks are managed acceptably. We will continue to work within this approval and regulatory environment. We are also committed to transparency and community consultation and will continue to discuss safety, health and environment issues accordingly. We are not, however, willing to participate in the poorly managed public discussions that have occurred in the Northern Rivers over recent years. Instead, we ask you to respect the approval and regulatory processes that exist and to participate in the associated review processes. If you are not happy with them you should approach the relevant NSW government ministers and justify changes to the processes and regulations.

As a final comment, we note that your paper refers to the “healthy worker effect” and the association between unemployment and lower health status and higher mortality rates. If you are genuinely interested in the health of the Northern Rivers people, shouldn’t you be promoting an industry that provides secure employment and income security for landholders? Surely, job security, supplementary income for farmers and a reliable energy supply go a long way to reducing stress, more than offsetting any discomfort associated with change.

Yours sincerely

Peter J Henderson
Managing Director and CEO

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