

Senate Inquiry on Unconventional Gas. Submission by Dr Steve Robinson

The Impact on Mental Health of Coal Seam Gas (CSG) Exploration and Mining

I am a psychiatrist, now retired, who has been living in the Gloucester area for 22 years and part of my practice was located at Gloucester Medical Centre where for 10 years I saw virtually all psychiatric referrals from the Gloucester Valley, which is the location of 2 open cut coal mines and the same coal basin was the location of the proposed Gloucester Gas (CSG) Project.

Exploration for the Gloucester Gas Project commenced in 2006 and continued until AGL cancelled the project and declared it not financially viable in February 2016. To my knowledge I am the only psychiatrist in Australia who has both lived and practiced in a CSG and coal mining area.

Public health is a very poorly resourced medical speciality and few medical practitioners have taken an interest in the health impacts of mining and so I found myself acquiring knowledge and lobbying regarding both physical and mental health impacts of coal and CSG mining. The integration of these two arms (physical and mental) of health science together with the socio-cultural impacts are essential in understanding the health impacts of mining.

This submission aims to explain how psychological damage and neurological damage from CSG exploration and mining interact, how psychological stress is usually the initial health problem and sensitises the human body and mind to further damage from pollution.

The importance of the psychological health impact of CSG mining

Mental health has traditionally been one of the least prestigious medical specialities, possibly because the brain has proved most difficult to investigate so that the scientific basis of this branch of medicine is least well developed (but now advancing rapidly). Linked to this past ignorance about brain function has been a stigma associated with madness. These factors have resulted in a disproportionately small level of funding and attention paid to psychological health e.g. teams of health professionals set up to advise about coal dust never include one with psychological expertise, despite brain and mental health impacts.

Traditionally when a body such as the Senate conducts a review of a health related matter it will be guided by a literature review of research. Probably the most recent and extensive such review of Unconventional Gas Mining is the Oct 2015 (3rd Edition) of the 'Compendium of Concerned Health Professionals of NY.....demonstrating risks and harms of....Unconventional Gas and oil extraction'. This 150+ page document devotes just 4 pages to "Noise, light pollution and stress", but this includes the key to the importance of psychological impacts of Unconventional Gas mining when it reports '**chronic stress magnifies individuals' susceptibility to the effects of pollution' (1)**. It adds that for children this interactive effect can begin in prenatal life.

The 'common sense' acknowledgement however, now by the community, of the importance of psychological factors is exemplified by this inquiry being instigated following the death by suicide of a cotton farmer, George Bender, who had been fighting CSG mining that affected his property for years. I am aware that there was at least one other suicide in that gasfield in a family greatly impacted by CSG mining. These suicides are just the most serious tip of the iceberg of psychological impacts. In the area where I live, where there has only been CSG exploration (not progressing to mining) and there is a smaller population, there have been no suicides. However time has been lost from work due to illness, I have seen marriages break up and many people being treated for a variety of mostly depressive and anxiety disorders including two cases of the rare 'transient global amnesia' interestingly triggered within our most active opponents of mining.

Many people psychologically disordered by mining stress are new cases of mental disorder but additionally if anyone has previously suffered a stress related mental illness that has been effectively treated, then this stress of unwanted mining intrusion/harassment often destabilises their treatment and they suffer a recurrence of their psychological disturbance. It was this aspect of mining that I saw most of professionally. The economic cost of all this psychological disturbance is never included in the cost benefit analyses of mines. It is borne by the individual, family and community. Never by the mine.

Origins of Psychological Disturbance

In the past half century we have come to the realisation that the most common situation is that there are multiple factors simultaneously affecting our emotional, behavioural and cognitive (thinking, working out, decision making brain functions) state at any one time. These several factors can be biological and psychological and socio-cultural in origin and interact, with the potential for being cumulative in the intensity and duration of stress they cause for the individual. Your genes may predispose or protect you from stress. Your early life experiences may similarly help you to be resilient or alternatively predispose you to psychological stress. If your physical health is being impacted by illness or poisons there is every likelihood your brain and nervous system functioning will be adversely affected.

Some groups of people are at greater risk than average. These 'At Risk' groups are characterised as:- the very young, the elderly, the chronically disabled/diseased and those socially disadvantaged. Any mining proposal should be doing a baseline Health Impact Assessment (HIA) and focussing on these individuals living in the likely affected zone. This (HIA) is the recommendation of the peak medical body (AMA), the Doctors for the Environment of Australia (DEA) and the Public Health Association but mining companies say they will only do this if legislated to do so and to date all Australian governments have failed its people in this regard.

Some stress is good for you. A small or moderate level of anxiety for a short time may improve your performance in some respects and it is abnormal to never experience anxiety,

but the longer the stress continues the more likely your body and mind will react adversely. The very lengthy duration of a mining project is a vital factor in the resulting chronic, 'toxic' stress which develops in some members of a community. However desirable your genes and upbringing may have been we all have a 'breaking point'. Acute (short lived) stress activates the adrenalin system of our body whilst chronic stress activates the cortisol (steroid) system and other endocrine glands. (Many fracking chemicals interfere with the endocrine glands). Prolonged stress including uncertainty which interferes with stress resolution unfortunately is the usual situation when you live close to mining.

The Exploration Phase of a mining project and the start of psychological stress.

The Exploration phase is when the community first hears about a mining project. Inevitably the gains will be emphasised, usually highlighting new jobs and economic prosperity, whilst the down-side (environmental, health and social damage) is hardly addressed so that the severity and geographical extent of the community likely to be affected is not immediately apparent. Nor that the gains and downsides will not be spread evenly through the community. This initial 'under the radar' phase in Gloucester lasted about four years and the community was eventually shocked into realisation by the 'Gasland' film.

When the affected community starts to work out the details it is common for a division within the community to become apparent. A few people in critical areas will be offered large amounts of money to sell their properties whilst those next door may receive no compensation, despite every likelihood of being impacted. Similarly a few people will be offered very lucrative jobs sometimes taking essential skills away from other non mining businesses in the area. This is the start of a likely break-up of the social cohesion of a community and individual family members can find themselves on opposing sides.

For some who believe such a mine is incompatible with their plans for the future they may put all their plans on hold to see what happens, or try to sell and find their property being close to proposed mining has dropped substantially in value and even with a much reduced sale price still no-one is interested to purchase. This results in feelings of being trapped, cheated, hopelessness and helplessness when there seems to be no solution. Their nest egg is eroded. These are powerful triggers for depression.

Any attempts to protest seem to be ignored by government who typically receive money from the mining company (e.g. Santos donating more than \$500,000 to party (LNP Coalition) funds, also AGL pleaded guilty to 11 charges of political donations). The government hopes for royalty money in the future to assist the budget and ignores the longer term health costs. In NSW a series of ministers (Kelly, Macdonald, Obeid) in the Resource and Planning Depts have been referred to ICAC re corruption. Time and again ministers or senior government officers leave their positions to take up very lucrative private mining executive positions selling the contacts and knowledge they obtained at public expense. This creates no trust in the government who typically at Gloucester retrospectively changed the law to

assist AGL from having to do an awkward Environmental Impact Statement regarding fracking 4 wells at Waukivory. There needs to be a much longer period where government officials are embargoed from switching to employment in the mining industry . Perhaps 5 years.

The inequality in the power influence between the individual and the government siding with large mining companies results in feelings of powerlessness and inadequacy which again are liable to cause depression.

Miners plant visibility barriers to hide future mining and this is the start of the loss of a once cherished landscape with resultant grief. This has been described by Professor Glenn Albrecht with the term Solastalgia. This was accepted as a big problem by the Mt Thorley – Warkworth (Bulga) Planning Assessment Commission but it isn't a medical diagnosis and this perhaps is the reason nothing was done about it. This grief/Solastalgia will intensify with the industrialisation of the rural landscape and when scarring of the landscape occurs. Several hundred wells with their pads and associated pipelines, processing plant and mining vehicle activity is not a pretty sight. Grief is known to adversely affect the immune system. This very understandable grief again is liable to lead to depression.

The local history and culture becomes negated when miners are permitted to buy up whole villages or encroach to a degree that makes living in a whole village unbearable. Whilst coal mining is a worse offender of destroying rural villages (Ravensworth, Warkworth, Camberwell, Wollar etc, and ?soon to be Bulga), frequently CSG mining overlaps with coal mining and the coal miners facilitate the CSG miners access to land that might have been disputed if still in private hands. In the Gloucester Valley the small communities of Forbesdale, Stratford, Craven, Wards River and Stroud Road are all battling to remain in existence with coal mining and would have also been affected by the proposed CSG field.

Rental properties became expensive and very scarce and tourist accommodation was taken over by drilling contractors for many months making it more difficult for tourists to find somewhere to stay and reducing the income possibilities for outdoor adventure tourism businesses who don't offer accommodation.

Gloucester had a steady stream of retirees coming to live in the area until publicity about mining hit the newspapers. Tourism operators in the area similarly reported a downturn in business. The weeks after AGL reported it was leaving Gloucester the enquiry rate for real estate jumped five-fold.

All of these above psychological stressors can have existed for a few years. They lead on their own to purely psychological disorders, and reduce the resilience of the immune system and start to cause cardiovascular problems before the significant biological (pollutant) and noise stressors become a major additional factor present.

Extent of Community Disaffection and Community Stress

At Gloucester several surveys of community opinion took place in this exploration phase and according to the wording of the survey between 60% and 75% opposed mining, 10 – 15% supported mining and about 20% were fence sitters. Clearly CSG mining did not have a social license.

Tensions in the community were seen with abuse being shouted from cars at displays protesting at mining and isolated more serious incidents requiring police surveillance. Both sides complained of harassment from the other side.

Global media is now so pervasive that virtually everyone living near unconventional gas mining has seen reports of the Porter Ranch underground gas storage facility in Los Angeles leaking 84 million kg of methane and has seen the bubbling of methane in the Condamine River lit by 'Frackman' and heard of great lengths of metal piping exploded into the air in the Northern Rivers. Clearly this is such a new industry that world best standards are still so abysmally low that allowing mining Queensland style is dangerous recklessness.

A research study (Assoc Prof Melissa Haswell et al of University of NSW) has been commenced to measure the level of psychological stress in the Gloucester Valley community and an initial finding was that stress was being experienced by both proponents and antagonists of mining. This is a work in progress.

The Mining license (PEL 285) covered the geological Gloucester Coal Basin which extends for 40km and at it's widest is 10km. On the surface this is Gloucester Valley from Stroud to Gloucester with a population of 6,000+. The mining proposal was to put approximately 330 wells down the whole valley. Wells would be every 600 metres because the chaotic geology made horizontal drilling impossible. Every well would have required fracking. In the area of the final exploration project, 4 'Waukivory Pilot wells', 50 residences (140 persons) lived within 2km of the wells. AGL were 'excused' having to have a buffer zone there. These wells were drilled, fracked, flared and water withdrawn for about 6 months and that community of Forbesdale were at risk of pollution exposure complicating their psychological stress. We requested an inspection by the NSW Health Dept. They came and told us that since it was in the exploratory phase legislation did not permit them to have any input! Public health experts should not feel their jobs depend on pleasing their political 'masters'.

A survey of community complaints by Ferrar et al in the US (2) in the Marcellus Gas and oil field reported that stress was the most commonly reported health complaint. A Health Impact Assessment from Lancashire in the UK (3) similarly remarked on likely stress and noise related 'key adverse effects' in two proposed shale gas mining projects.

Neurological damage on top of Psychological Stress

Exploration can still involve considerable exposure to polluting chemicals since about 16+ wells at Gloucester were taken to production capacity and about 35 wells at the Pillaga before production has commenced. Many of the chemicals are toxic to the neurological and the endocrine systems and in turn have effects on cognitive, emotional and behavioural brain functions. These chemicals include the BTEX group (carcinogenic and neurotoxic) and other hydrocarbons such as PAH, heavy metals, naturally occurring radioactive materials as well as particulate matter including silica.

The cattle eating the pasture and breathing the polluted air with very little monitoring are at risk of becoming sick and producing contaminated milk and beef. The cattle industry is particularly sensitive to endocrine disrupting chemicals. Their products also enter the human food chain and risk discrediting the local agricultural industry with grave financial implications. (4) In this time of population increase and food scarcity you would think governments would value our food producers and rural communities.

The necessity to drill, hydraulically fracture, withdraw fluid, vent and flare the wells for many months to test the extent of the resource whilst still in the exploratory phase introduces realistic fears of being poisoned whilst having to endure noise levels which can disrupt sleep and impair concentration during the daytime also making communication more difficult for the elderly with hearing problems.

Children are particularly at risk of adverse effects because their brains and lungs have not fully developed and comparatively for their body weight they eat more, drink more and have a greater proportionate surface area exposed to toxins. Dr Geralyn McCarron was particularly horrified at the very high rate (30%) of neurological abnormalities present in the 48 children when she examined 113 residents of the Tara Gas Field. (5) A very recent (16/2/2016) reported study by Prof Mark Taylor et al of Macquarie University (6) showed exposure to lead in the air as a child was strongly associated with antisocial behaviour and criminal activity including death by assault as an adult. This just demonstrates the sensitivity of the developing brain and the potential dire, very long term psychological consequences of brain damage early in life.

Cumulative Brain damage

Lead is the heavy metal whose adverse effects have been most extensively investigated and its effects include lowering of intelligence and academic achievement. In the Gloucester Valley the sulphur released into the air by coal mining causes acidification of rainwater being used and collected in domestic rainwater tanks. (No mains water in the bush). The sulphur attacks lead and copper in the roofing, guttering and paint of residencies with the result 20% of homes, particularly older homes, have domestic water with unhealthy heavy metal levels. (Assoc Prof Damian Gore, Macquarie University – work in progress). Lead from the roofing spills onto the soil and is tramped into the home where it is inhaled in house

dust. Thus those on bore water can also be affected. The CSG production fugitive emissions have a similar acidification risk.

Other heavy metals such as mercury also are toxic to the brain. (Mad as a Hatter refers to people poisoned by mercury used in hat making). Unfortunately there are at least two other causes of neuro-cognitive damage that individuals in a CSG mining area may be exposed to that may be cumulative with that from metals. These are Polycyclic Aromatic Hydrocarbons (PAH) and noise induced sleep disruption.

PAH chemicals are produced when hydrocarbons are incompletely burnt. This occurs in a gasfield with diesel vehicles, machinery, pumps and generators etc. They have been most intensively studied where the source of PAH has been city traffic in New York. Prof Frederika Perera (7) gave pregnant mothers sensors which measured their personal level of exposure to PAH whilst pregnant and then measured the intelligence (IQ) of their children when they reached Age 5 years. After controlling for factors like tobacco smoking and social class she discovered the children of the mothers with the highest PAH exposure had IQs between 4 and 5 points lower than those with low level of exposure to PAH.

Noise as a stressor

Noise is notorious as a stressor of the auditory cranial nerve and associated brain pathways which include learning, memory, speech etc. Very loud noise can damage hearing and this has been reported in Mesa Verde National Park by Barber JR et al where 64 compressors increased the noise level by up to 56 decibels. The safe level to avoid hearing damage is a level of 55 decibels. In Dec 2014 Range resources in Pennsylvania reported a flaring would produce a noise level of about 95 decibels continuously for a week at the wellpad.

Far more common than excessively loud noise is continuous or frequent noise at a lower intensity but loud enough to be annoying and/or to wake a resident from sleep. Night-time noise and daytime noise are each a problem. In the daytime noise impairs concentration and learning and makes communication even more difficult for the hearing impaired. Night-time noise disrupts sleep even if it doesn't always wake the person. Often very large machinery produces a large component of low frequency noise which humans are wired to perceive as threatening whether awake or asleep. Low frequency noise is conducted through solids by vibration and so is not effectively suppressed by noise insulation which suppresses middle and high frequency noise which is conducted through the air. Some individuals are particularly sensitive to noise in the same way that people's sensitivity to motion sickness varies widely.

In California noise from well stimulation was responsible for both sleep disturbance and cardiovascular disease in a dose response relationship (the more noise the worse the effects). Chronic noise can be deadly. The World Health Organisation (WHO) has investigated the effects of environmental noise and found it increased sleep disturbance,

cognitive impairment, tinnitus and cardiovascular disease. It found at least one million “healthy life years” are lost every year from traffic noise in western Europe (8).

Sleep Loss is notorious in causing increased drowsiness the next day and consequently a safety hazard for driving and working machinery. In the Gloucester Valley we have performed ‘baseline’ questionnaire monitoring of Sleepiness and Sleep Quality using the Epworth Sleepiness Scale and the Pittsburgh Sleep Quality Index in over a hundred persons and found in the elderly population around Waukivory Pilot wells 28% (6 out of 21 persons tested) already had excessive sleepiness and overall 20% of those 110 persons tested living near mining had an impaired sleep quality of a degree that would warrant referral to a specialist sleep clinic.

Light

It is normal for gasfields to be brightly illuminated at night. Again people vary in their sensitivity to the effects of bright artificial night light. It can interfere with the circadian rhythm and melatonin secretion which can be an important influence on depressive and manic illness. The bipolar (manic depressive) illness, seasonal affective disorder, is particularly sensitive to destabilisation by bright light. Light has also been implicated in increased incidence of breast cancer.

Odours

This is another sense in which individual sensitivities for it being a stressor have a wide variation. The sulphur component in the air is usually the culprit and the risks and the additional implications for the sulphur bringing heavy metals into solution have been outlined above.

Conclusion

Unconventional Gas Mining has disastrous results for the psychological health of humans when it is carried out in even thinly populated areas. The suicide which triggered this inquiry is just one tragic example. Chronically stressed persons are sensitised to the physical health impacts of potential toxins released by this industry. **Independent Health Impact Assessment including psychological health should be mandatory for all mining projects.** The precautionary principle argues that **no new Unconventional Gas Projects should be commenced** until safety for the affected community can occur. Currently government regulation is woefully inadequate and regrettably government is frequently in collusion with the industry and acting against the people. Community health is one important casualty.

References

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AGL VIGIL

Where are the people who say they care -
why don't they come and join us in the fray?
My heart feels weak and heavy with despair.
Let's all stand united - straight and square!
Yet piece by piece I'm shrinking away.
Where are the people who say they care?
Some drive past and shout and swear;
I'm tired - I want peace; but this not the way;
my heart feels weak and heavy with despair.
Our planet won't cope with ceaseless rip and tear.
We all want our home at the end of the day.
Where are the people who say they care?
Again I pull my fingers through my hair.
My gloom gets worse; I feel my decay:
my heart feels weak and heavy with despair.
We can't take for granted clean water, clean air;
this endless fight - how long can I stay?
Where are the people who say they care?
My heart feels weak; I feel such despair.
Elizabeth Bartlett March 2016