**Submission to IPC re Santos’ CSG project at Narrabri**

I am a NSW resident and medical practitioner with a longstanding interest in the environmental determinants of human health.  I am basing much of what I say here on a comprehensive 2019 report by Prof D Shearer (Uni of Adelaide) and Prof M Caswell (QUT) on the implications for human health and well-being of expanding gas mining in Australia.  However I have also personally researched Santos’ environmental track record in detail, and shall conclude  with a number of remarks about that.

To begin with, I will paraphrase and discuss the well argued and heavily referenced report by Professors Shearman and Caswell.  They are the first to admit that because there has been relatively little research on the effects of CSG mining in Australia, many of their supporting stats come from the USA with its rapid expansive development of gas fields.

OVERVIEW

They found clear evidence of the industry’s rising greenhouse gas footprint, threatening global efforts to reduce emissions.  This footprint is often underestimated for several reasons, including: failure to consider the whole lifecycle of gas production; underestimation of the quantity and duration of fugitive methane emissions; too long a time frame when assessing the global warming power of methane (86 times that of CO2 when measured over 20 years, not 100); inadequate weight given to large methane-leaking accidents.  To these my own research must add highly likely widespread ‘failure to report’.

A second major concern was the large number of toxic chemicals used in both drilling and hydraulic fracturing, released into the environment through air and waste water, and emitted from high site industrial activity.  Many of these chemicals have not been evaluated, some are known carcinogens, endocrine system disrupters, and cause neurological / reproductive / developmental harm.  They include volatile organic compounds eg benzene, heavy metals, huge volumes of salt, concentrated naturally occurring radioactive materials, formaldehyde and ozone.  Many of the reviewed studies evidenced ground and surface water contamination through spillage, injection procedures, and deliberate discharge of inadequately treated water and its leakage from wastewater pits and ponds.  Residence close to CSG facilities shows accumulating evidence of poor health: worse asthma, sinusitis, migraine, rashes, fatigue and increased rates of hospitalisation for many serious illnesses.  Similar trends are emerging in Queensland, confirmed in surveys carried out by Dr Geralyn McCarron.

There are consistent observations of negative birth outcomes and some birth defects from pregnancies spent within 2-3km of gas mining, higher rates within 1km. Increased levels of stress, depression, aggression and criminal activity reflect psychosocial disturbance in surrounding communities.

Of special concern in Australia is the huge increase in water usage in already drought-affected farming communities. The review strongly emphasises that new gas developments work against reduction of greenhouse gas emissions, stressing the enormity of health, economic, security and environmental costs of an insufficient response to global warming.  The 2018 report of the IPCC cited the speed at which the world can give up coal, gas and oil as a major determinant of future health and prosperity.  Australia is among the world’s top exporters of gas and coal, and so far most of our unconventional gas has been produced for export.

THE MINING PROCESSES

Unconventional gas extraction requires more invasive techniques:  systematic dewatering of aquifers, horizontal drilling and hydraulic fracturing; with hundreds to thousands of wells spread across vast areas, as the gas is widely dispersed.  The distinction between conventional and unconventional gas extraction may be clouded - both often cover huge areas of land.  Lubricating drilling “muds” have multiple chemical additives which return to the surface; and drilling allows harmful chemicals to migrate upwards and appear in aquifers through which drilling has passed.  Ageing wells have wear-out failures due to rusting, electrolytic corrosion and acid dissolution of metal and concrete - causing long term contamination and fugitive emissions.  US and Canadian studies show 9-28%  gas leakage through surface casing vents. By 15 years of age a well has a 50% chance of gas build-up in its casing annuli.  Fracking uses huge volumes of water, with a risk of reactivation of seismic activity by forceful injection of fracking fluids.  A 900-fold increase was observed in Oklahoma.  Waste water from coal seams may contain naturally occurring radioactive isotopes, arsenic, mercury and volatile organic compounds - concentrated, and all harmful to human and animal life.  It may be evaporated from large holding ponds , sprayed onto local roads or paddocks or discharged into rivers - dispersing residual chemicals into the environment.  Methane from wells may contain toxic chemicals and may be treated by flaring, producing CO, CO@, N2O, NO2, and SO2 - contributing to climate change, acid rain and respiratory illness.  There is significant direct loss of methane to the atmosphere from accidents and just normal operation.

GLOBAL IMPACTS

Atmospheric levels of methane cause 17-25% of global warming, with oil and gas production accounting for 48-75% of total methane emissions from human activity.  To limit global warming to 2 degrees, half of all gas reserves must remain unused; for a target of 1.5 degrees, far more than half known gas and oil must stay in the ground.  In America, abundant methane has competed with renewable energy, delaying urgent transition rather than bridging.  Accidents with well blowouts and methane storage site leakage there have had a hugely negative climate impact.  Queensland alone of Australian states has well established fracking, and produced 29% of our total emissions in 2016, with fugitive gas emissions steadily increasing and among our top 5 emission sources. From gas and oil they more than doubled in the 4 years to 2018, surpassing methane emissions from coal.  Shale gas mining may cause huge “super-emitting points”, and “migrating emissions” at long distances from each well.  Australia has had no rigorous independent auditing of gas emissions, and as with coal, gas prices ignore many  ‘externality costs’ borne by local communities: environmental loss, climate impact, damage to health and wellbeing, psychosocial conflict.  Australia’s massive gas exports may be driving down the international price, ‘undermining’ other countries attempts to decarbonise.

LOCAL AND REGIONAL RISKS

There’s a wide range of chemicals used in the process, and many naturally occurring ones are brought to the surface with the huge volumes of waste water.  Leaks and spills are frequent in unconventional gas mining, though grossly under-reported in USA and very probably here. Of 113 chemicals used for fracking here, at least 44 are harmful to workers if exposed; at least 40 will harm communities exposed by drinking or swimming. The effects of many are unknown.  The major known risk to US workers is deadly silicosis from exposure to large quantities of “frac sand”.  Saline waste water contains many toxic naturally occurring chemicals, and flaring excess gas releases these too.  We are talking here about carcinogenic benzene - found in surface spills, also aromatic hydrocarbons, heavy metals and radioactive isotopes including uranium, thorium and radium, concentrated by the process.  Australian studies have found 60 such chemicals and identified many for further toxicity studies.  Vast amounts of salt are produced - a major environmental hazard to local ecology and farming.  A US study of 119 chemicals in waste water found 69 known or likely carcinogens, 20 associated with leukaemia or lymphoma.  Another study found 1021 wastewater chemicals, evaluated 240 and found 95-103 with reproductive and developmental toxicity.  There was moderate evidence of a higher risk of premature birth, miscarriage, birth defects, poor semen quality and prostate cancer - all relating to endocrine disruption.  Five chemical groups could expose infants and children to neurological and neurodevelopmental harm.

Water security - CSG mining’s effects on water quality and quantity - is another huge issue, especially with worsening droughts as climate change progresses.  Many CSG deposits are in areas where groundwater is already depleted, as at Narrabri, so there is competition with food production, livestock survival and other human uses of water.  Contamination of aquifers and surface water may render them unusable, and unconventional gas mining uses much more water per well.  An American study reported 770% increase in regional water use intensity per well, and 1440% per well increase in waste water. In Australia, RMIT hydrogeologist Dr M Currell described a major lack of baseline data and resources for monitoring Santos’ compliance with protecting water resources at Narrabri.  The cumulative impact of hundreds of wells over decades, along with soil contamination and competition for land use, will impact food security and therefore human health; especially with increasing drought, toxins transferring to food chains, and increased soil salinity.  In America, water-deprived farmers have irrigated crops with CSG waste water; saline waste water can mobilize heavy metals already present in soil  and coal seams, including uranium and cadmium.

Air emissions also loom large.  Chemicals reach the atmosphere from flaring, venting, holding ponds, compressors and other infrastructure.   US data suggests that air pollution is at least as dangerous to nearby residents as water contamination.  Many of the released toxins can affect foetuses and developing children, at low doses.  US studies have shown that people exposed by living nearby are at risk of respiratory, endocrine, cardiovascular and nervous system diseases, including cancer.  Ground level ozone formed from admixture of CSG pollutants can travel large distances and worsen asthma.  In Queensland’s Darling Downs 133-142% increases in hospitalisation for cardiorespiratory illness coincided with a sharp rise in gas production.  Dr G. McCarron’s 2013-14 local surveys found higher rates of headaches,  nosebleeds and paraesthesia.  An American study reported 25% increases in low birth weight infants in mothers living within 1km of fracking, with lesser but increased risk at 2-3km.  Other studies reported higher rates of childrens’ blood cancers in CSG mining areas in Queensland, with 9% higher admission rates for paediatric cancer and 14% higher for blood and immune diseases; also a 467% increase in blood/immune disease among 5-9 year olds, and a 25% increase in paediatric admission rates for asthma within 3 months of the start of fracking.  Reported social and mental heath impacts here and overseas have included increased crime, depression and anxiety, including the suicide of an Australian farmer in 2015.  Effects on indigenous communities will be worsened by their already substandard living conditions and often unreliable water supplies, increasing with remoteness, especially when fracking is imposed against their wishes and threatens cultural sites.  They already suffer high rates of chronic disease and mental health issues.

The regulatory framework has been inadequate and unproven.  US EPA reporting shows that adequate monitoring and detection have failed to occur.  Professional US medical bodies have jointly concurred that “regulations have not prevented significant harms......some harms are not preventable through regulatory opportunities.”  Even if risk elimination were possible, can governments satisfactorily respond to the multiple hazards - chemical, physical, mental and social - posed by very large numbers of producing and ageing, depleted wells?  Of course this also depends on future commitment of political leaders to place human health above industry demands.  Professional health organisations have described the unconventional gas boom as an uncontrolled experiment with human health, due to incomplete disclosure of key information.  Multiple Australian public health and medical groups have highlighted and deplored the lack of evidence for safety for health.  They agree with similar groups overseas that actions taken to prolong the use of gas for energy pose unacceptable risks to the climate and our health.  Such groups, including our AMA, have called for application of the precautionary principle, including that the proponent of the activity must prove safety, not the public.  It has been stated that the uncertainty over the health implications of CSG is greater than for any other energy choice, that precaution is justified on the basis on health risk alone.  As the AMA said: “If in doubt, turn CSG off.”  Several countries and states have banned fracking or imposed moratoria, including France, Germany, Bulgaria, Scotland, Wales, New York, Nova Scotia, Newfoundland, Quebec, New Brunswick and our own Victoria.

Santos has a poor environmental track record with very many significant toxic spills and leakages over the past 20 years - the period I examined in detail - making it clear that Santos cannot be trusted to look after the environment.  There have been at least seven large spills in the Narrabri project area already, some reported late or discovered by the community. Here are a few examples from a long list: 2014 aquifer contamination from Bibblewindi (near Narrabri) waste water storage site with heavy metals, and uranium at 20 times safe drinking water guidelines; a 250,000L oil spill on the Coopers Creek floodplain in 2013; hundreds of small and many large breaches, with at least $375,000 in fines; explosions in SA in 2001 and 2004, with one worker killed; 4 pollution incidents at Gladstone Harbour in 2011, one of which went unreported for 8 months; late 2011 Bibblewindi wastewater spill of 10,000L, unreported, with failed revegetation; Feb 2012 groundwater contamination with toxic heavy metals at Pilliga Forest drilling site; Dec 2012 fine for late reporting of oil spills, Curtis Island, Great Barrier Reef World Heritage Area; May 2006 mudflow disaster in Sidoarjo, Indonesia is ongoing, has destroyed 40 villages and displaced 40,000 people (Santos sold out in 2009, left $m33.9 for reparations); June 2019 pipeline rupture and explosion near Innamincka SA closed the Strzelecki Track for a while.

The corporation has ignored community opposition, with large surveys across northwestern NSW showing an average 96% respondents want to be gasfield-free.  There is no social license for the project.  It paid little or no corporate tax in 2017 and 2018, and often pays little or no royalties in NSW.  Journalist Michael West’s Top 40 Tax Dodgers rates Santos at #5; and this in spite of using community and government infrastructure, services, water and fuel subsidies.  Santos’ activities in PNG caused massive social problems due to poor initial risk assessment by the corporation and its partners.  Landowners missed out on promised royalties and other benefits, and the PNG Government received very little in taxes or royalties.  The Australia Institute found that most benefits went to foreign shareholders, and that “the PNG economy would have been better off without Santos’ LNG project.” Alternative development of renewable energy industries in the Narrabri region will create much higher construction phase and ongoing employment.  The negative impacts of Santos’unconventional gas project, especially on water supply and quality, will be long term, persisting very long after the short term CSG industry is finished.  All this is underscored by the insurance industry’s recent refusal to insure farmers against the risks of CSG mining on their land.

In conclusion:   The most important implication of CSG mining is its carbon footprint.  Substantial research has highlighted its major contribution to fugitive methane and CO2 emissions.  For this and other reasons, development of new gas resources is a very dangerous gamble for humanity.  The safety of gas mining to people and the environment is contradicted by current research, and Australia should urgently assist developing countries to transition away from gas -  instead of continuing to supply vast quantities on the world market.  Santos has a poor environmental track record, and CSG mining is a very dangerous technology which must profoundly weaken this country’s efforts to curtail greenhouse gas emissions.  Santos’ CSG project at Narrabri should not proceed.