Dear Secretary

I have been informed that the Parliamentary Committee will be in Sale on June 30 and Weds July 1 and I do recommend that the Committee has time to visit Gregor McNaughton's property on the Seaspray Road where Gas exploration has been undertaken .
I am on The VFF Land Management Committee & member of the Gippsland Mining & Gas Taskforce and have been a member of the NFF Mining and Gas TF. I Chaired the VFF Mining Subcommittee for 30 years . However the VFF will be making their own submission (in which I will have input) .
I would like time to present to the Committee with my regional hat – looking at co- existence and integrated benefits that could benefit the Gippsland regional economy.

I would prefer Tuesday 30th or early Weds .
I have encl a short summary of the Dairy Australia report (AA comment and the summary report of the Study FYI)

Alex Arbuthnot AM


15 Dairy Report CSG AA.doc 
15 CSG- Dairy Australia discussion paper summary 19aug14.doc

Dairy Report CSG

Briefing Report SLR Consulting

Summary Alex Arbuthnot, April 2015

This 160 page report is probably the most comprehensive report available on CSG and unconventional gas covering statute, regulation and information; - national and across the States. Although primarily provided for the Dairy Industry it can be used as a reference as it is a library of information. *I do note that this industry is fast moving and changes have made data and some activities already ' out of date'!*

Note the report refers to the joint development by APIA and the VFF (Aust. Pipelines Industry Assoc) on National Easement Guidelines.

Also note 2 States are developing BMP Guidelines for Gas Development on private land – I recommend that the Victorian Govt (with industry, VFF and Environment) also develop Guidelines.

A 6 page Summary Paper has been prepared which is a 'must read' for anyone with an interest in CSG.

Comment and Summary points

- The six chapters in the report (planning. Water, food prod'n, animal & people safety, env. risks ,etc) are issues that cover broader agric. and community concerns and not dissimilar to other mining and energy encounters.
- Gas industry in Queensland currently employs 27,000 people & APPEA estimate the potential to employ 20,000 in NSW. Gas exports in Queensland valued at $15 billion and Grattan Inst. estimate by 2017 could rise to $53 billion.
- On high producing dairy land – the footprint is extensive – with the biggest threat potentially being infrastructure (pipelines & processing) – *even on my intensive dairy farm in the Macalister Irrigation District(MID)- I can locate a well head on an unused site but the positioning of pipelines (water, gas, storage etc) would be a major planning issue!!*
- Some excellent tables – Table 1 on page 14 on gas types (CSG, Shale, etc) and location, impacts, technology, water usage etc. provides an excellent overview.
- note 25% of all energy used in Australia is from gas

- also note the report says due to a ban on exploration work in Victoria there is a lack of key information on potential resource size. – however onshore Otway and Gippsland basins are most likely. (22 Expl. Licences have been issued – 18 in Gippsland)

- horizontal drilling has emerged as an alternative to fraccing. To date less than 5% of CSG wells have been fracced (*why do the Greens make so much noise on this issue*

- note there are pages & pages on regulations covering: well construction, well closures , monitoring. water treatment, fire management, fraccing fluids ,rehab etc – *and the 'doubting Thomas's ' should read.*

- A chapter on community concerns (covering 14 issues) note SCER report from Canberra covered 26 issues – note section on dairy food safety. *And note the Vic Petroleum Act covers risk assessments on community concerns incl social issues !*

- Note the IESC (Independent Expert Scientific Committee) is doing six Bioregional Assessments (one covering Gippsland bioregion) – to be completed by 2016.

- National Water Commission estimated that produced water from CSG mining in 2 basins in Queensland in nearly 300GL pa – this can be used for irrigation, town water or for environmental river flows.

- The report covers in the appendix – a list of current research projects on Gas issues and contacts etc (appears to be hundreds) - note 4 R projects on subsidence, and projects on community well-being, human health (Sydney Uni) , and cumulative impacts (*often wondered if we measured the cumulative impacts of cities ?)*

- <u>The General Conclusion on page 143 is a must read</u> (along with the table on page 14)

  <u>I</u>n summary says " Gas mining could be described as both agricultural as well as industry – it operates in a rural landscape , transports its raw material to processing facilities & produces a product for domestic and export markets. Similarly dairy operates in the same way and there are synergies in risk and community annoyance – with odour , waste water treatment etc – suggest that beneficial co-existence may be obtained if both industries engage to address concerns through open communication !

  Co- existence is already occurring between gas mining and dairy sectors and Queensland is learning ground for other States .

  In NSW dairy farms at Camden have lived cooperatively with a small scale CSG industry for 12 years. In the Gloucester Valley exploration and gas production is progressing and the dairy industry appears to be embracing the concept and searching for opportunities to advance the dairy industry (*three cheers) – AA comment - surely Sale is an example where the top dairying area has co-existed with ExxonMobil for 50 years – let's look for opportunities ? I believe the Green political party does not want co-existence and has a vested interested in the groups " in conflict" !!!*

Summary of briefing report on CSG and dairy[1]

Introduction

Dairy Australia in March 2014 commissioned SLR Consulting Australia to prepare a briefing report to on how unconventional mining may interact with dairy farming. Issues include water, chemical use, well integrity, food and fodder safety, disruption, and the legislative and regulatory frameworks.

What is unconventional mining?

Unconventional, or onshore, gas mining has three forms: coal seam gas (CSG), tight gas, and shale gas.

CSG is a natural gas located in water-pressurised coal seams 300 to 1000 metres underground. Drilling a well into the seam releases the water, which is pumped to the surface, thereby reducing pressure in the seam and enabling the gas to flow. Wells generally have a 12-15 year life span.

Shale gas and tight gas occurs more than 2000 metres underground. They require specialised technologies such as directional drilling and hydraulic fracturing. Their development in Australia is still in its infancy due to the added difficulties and costs involved.

What is fracking?

Hydraulic fracking is one way to improve gas flow. It involves injecting fluids containing sand or small ceramic grains under pressure to fracture a rock, and improve the flow of water and gas in a well. About 60-80% of fluid flows back to the well immediately, with further recovery over a longer period. Fluid is brought to the surface and treated before reuse or disposal.

Less than 5% of CSG wells in Australia have been fracked so far. Between 10 and 40% of wells yet to be drilled may need some form of flow enhancement, including fracking.

Horizontal drilling is emerging as an alternative to hydraulic fracturing, and is increasing used in Australia. It involves up to six horizontal wells drilled from one surface site, creating gas flow paths.

Dairy Regions and CSG zones (p18)

Queensland: Dairy and CSG has little existing or potential coexistence, with dairy regions primarily mapped outside geological basins or areas of activity approved for development.

NSW: Exploration or production is occurring in several dairy regions, primarily the North Coast, Hunter, Greater Sydney and Central Tablelands. These have 407 dairy farms, producing 432ML a year.

Victoria: The Gippsland and Otway Basins have the highest potential for unconventional gas. The affected Gippsland area has 1430 dairy farms producing about 2000ML a year. In south west Victoria, about 600 dairy farms are in the area overlaying the Otway Basin, producing about 840ML a year.

[1] 'A review of the key considerations on the current and potential interactions between dairy and unconventional gas mining activities in co-existing regions of Eastern Australia'. Briefing Report No. 630.10836, July 2014. SLR Global Environmental Solutions.

The Murray Basin underlying parts of the Murray Dairy region in northern Victoria/southern NSW Riverina is not considered to have the same economic development potential.

Victorian CSG potential

Victoria to date has no unconventional gas production, commercial reserves or even confirmed resources despite numerous exploration licences being issued since 2000. The CSG potential of Victoria's brown coal deposits is less well known than Queensland and NSW's black coal deposits.

It may also be the case that any CSG in Victoria's brown coal deposits may be harder to extract and therefore more costly to produce. The Otways basin is relatively deep, with a higher CO2 content than resources in Queensland and NSW, requiring additional facilities to process.

Low permeability in the Gippsland Basin may also requires deep horizontal drilling and fracking, resulting in expensive well costs.

CSG well integrity

Once drilling reaches the required depth, the CSG well is cased with steel and the gap between steel and the rock is pressure-cemented from the coal seam to the ground surface. This is to ensure that all the formations, including aquifers, are isolated from fluid and gas passing from inside the well.

At the end of their life, production and exploration wells are sealed with concrete from top to bottom to prevent leakage and allow adequate rehabilitation of the surface area. Alternately, a cement plug may be inserted into the casing to the uppermost level of the hydrocarbon production zone, and pressure-tested to ensure no leakage.

Chemicals use

In NSW, CSG companies must identify all additives used on site; their Chemical Abstract Service registry numbers; volumes and concentrations; potential human health risks; risk, likelihood and consequences of spills; whether concentrations will exceed required specifications such as drinking water and toxicity levels; risk of affecting aquifers, and how additives will be stored and managed.

Drilling: CSG wells are drilled using a biodegradable lubricating fluid which is generally a mixture of water, clays and additives such as bentonite, cellulose, polymer, barite and guar gum.

Fracking: Fracking fluid is 97-99% sand and water. The remainder is commonly-used biodegradable additives for lubrication and to prevent bacterial growth. Commonly used additives include:

- guar gum (a food thickening agent used in ice-cream);
- sodium hypocholorite (used in pool chlorine, and also as a sanitiser in dairy plants such as pipes, tanks and heat exchangers, and as a disinfectant in town water supplies);
- sodium hydroxide (also known as caustic soda, used to make soap and to clean dairy plant such as pipes, thanks, and heat exchangers);
- ammonium persulphate (used in hair bleach);
- ethanol, orange oil;
- acetic acid (vinegar), citric acid and sodium carbonate (washing soda) (all cleaners that can be used for dairy plant);
- borate salts (herbicide, fungicide, pesticide) and monoethanolamine (used in wood treatment, detergents and surfactants);

- hydrochloric acid to remove scale (also often used in dairy storage and processing)

Mandatory codes of practice in NSW and Queensland require that all additives must be tested by a National Association of Testing Authorities (NATA)-certified laboratory to demonstrate compliance with the Australian Drinking Water Guidelines.

BTEX: The use of additives containing BTEX hydrocarbon compounds (benzene, toluene, ethyl benzene and xylenes) is banned in NSW, Queensland and Victoria. BTEX compounds are considered an unacceptable environmental risk, as they are soluble in animal fat and blood.

Produced water

CSG is usually released by removing water and therefore pressure, from the coal seam. This water called 'produced water'. Produced water also includes any flow back fluids from fracking.

Produced water is not water from surrounding aquifers and is chemically different to freshwater and other groundwater sources. It is generally high in dissolved salts, metals, dissolved or dispersed oil compounds (which may include naturally occurring BTEX compounds), dissolved gases and naturally occurring radioactive materials.

Pollution may occur through discharge from surface pipes or leaks from surface water infiltration; well integrity failure; and, changes in aquifer pressure through releasing gas and water from the coal seam.

Produced water quality varies, but is often brackish (3000-7000 mg/L TDS). This compares with seawater (36,000-38,000 mg/L) and good quality drinking water at less than 500 mg/L. Tolerance levels for lactating dairy cattle are considered to be less than 2500 mg/L, and

Produced water is rarely fit for human or animal consumption, or for irrigation or environmental use, without treatment.

Produced water management

Evaporation ponds were once widely used in NSW and Queensland but are now banned. All projects must now collect and transfer produced water, usually through pipes, to treatment facilities where it is stored in large lined ponds pending treatment. Dilution may be all that's required, depending on the chemical composition of the produced water.

Reverse osmosis or a similar technology is used to remove dissolved solids and other additives; RO can filter up to 95% of salts and organic compounds from water. Disposal of the brines and residual solids and slurries is not fully resolved, with waste still being stored in brine and salt pits in many cases.

Methane and recoverable hydrocarbons can be extracted and separated from produced water, bringing final concentrations to within Australia and New Zealand Environmental Conservation Council (ANZECC) guidelines.

Re-use of treated produced water

In the Gloucester region in NSW, a study initiated by the local council evaluated the potential re-use of produced water for irrigation and livestock watering. Its produced water quality surveys found:

- high sodium and chloride concentrations;
- low dissolved metal concentrations, considered naturally occurring;

- traces of toluene and benzene (BTEX compound) but benzene was below ANZECC and Australian Drinking Water Guidelines triggers. Toluene does not have a trigger value; and,
- low total petroleum hydrocarbons, separable from produced water through treatment.

The surveys confirm that produced water must be treated to be fit for human or animal consumption, irrigation, or infrastructure wash-down purposes. Farmers considering using treated produced water must obtain proof from CSG companies that the water meets Australian Drinking Water, ANZECC and other relevant guidelines and standards.

Aquifer integrity

The mandatory use of impervious lining (steel casing and cement) reduces the likelihood of any chemical additives entering groundwater systems.

Fracking creates a pressure gradient towards the well, so that 60-80% of fluid flows back immediately, with further recovery over a longer period. Fluid is brought to the surface and treated before reuse or disposal.

CSIRO is leading groundwater modelling to predict the extent to which coal seams are connected to aquifers, and whether drawing water from a coal seam may affect aquifers and over what time scale. It is worth noting the experience in south Gippsland, where falling groundwater levels around Yarram over more than 30 decades were eventually linked to extraction of oil and gas in Bass Strait.

Fugitive emissions

CSG is typically 95-97% methane, with smaller amounts of nitrogen, carbon dioxide and other gases. Methane is considered a low toxicity gas, with no effects on human or animal health at common concentrations. It is highly explosive at between 5 and 15% concentration. At higher levels, it reduces oxygen which lead to asphyxiation; such levels are usually associated to enclosed, unventilated spaces.

Methane can vent naturally through existing geological faults or groundwater bores. Fugitive emissions, defined as unintended emissions resulting in air pollution or economic loss, can occur through leaking pipes or faulty valves. Methane is lighter than air, and rapidly rises and dissipates.

Livestock farming, particularly cattle, is the major sources of methane in rural areas. Most carbon dioxide and other air pollutants come from vehicles and fossil fuels used for pumps, generators and other equipment.

No standard currently exists for gas leaks from CSG field activities, or processing plants. Queensland, in developing its Code of Practice for CSG Well Head Emissions, used the Australian Standard for natural gas distribution networks in CBD and urban areas as its default reference. This standard could be considered to provide a greater risk and consequences level than leak from a rural gas field.

Queensland's standard leak methodology requires gas/air content to be measured at 150mm from sources, with all leaks being reportable above 10% of the lowest flammable concentration of 5%. This exceeds the common 20% standard at 200mm used by gas processing plant operators, with significant infrastructure often in confined spaces.

In NSW, the Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales (EPA, 2005) is used to set limits and methodology for detection, although this document is more tailored to plant emissions rather than in-field scenarios.

Pasture and fodder residues

A crop nutrition report by Fodder King, a member of the Australian Fodder Industry Association (AFIA), and Animal Nutrition Consulting Services (ANCS) found that crops grown using treated produced water met AFIA's nutritional standard. Mineral and trace metal content was found to be acceptable, and comparable with levels in crops irrigators with other groundwater and surface water sources.

AFIA's Commodity Vendor Declaration Form requires that where fodder is supplied to a client with a QA program, such as dairy, a full list of chemicals, rates and dates of application must be provided.

Fodder must be chemically treated in accordance with the National Registration Authority for Agriculture and Veterinary Chemicals. The producer must also declare the property on which the fodder was grown, or storage facilities, are accredited under a recognised QA program, including chemical residue management.

Where treated produced water is tested to meet ANZECC Guidelines, or the Australian Drinking Water Guidelines, the water would not be considered to be a chemical treatment.

Food safety programs

Under the FSANZ 4.2.4 Primary Production and Processing for Dairy Products, all dairy farms, manufacturers and processers must have a documented food safety program.

These programs are designed to address 'usual' dairy practices. It is foreseeable that where CSG activities are undertaken on dairy farms, new potential chemical and biological hazards may have to be identified and increased scrutiny applied to allay consumer concerns. This may increase the usual costs and labour hours for implementing a QA system.

Food safety programs include measures to prevent, eliminate or reduce the introduction of chemicals and microbiological hazards that may indirectly be introduced to milk from feed with unacceptable residues. Vendor declarations from all stockfeed suppliers ensure outside feed is sources, prepared managed and treated to avoid contaminating the milk supply.

Fodder supplied from any vendor where CSG produced water is used would be subject to AFIA's vendor declaration process. It means the composition and concentration of any remaining (if any) additives in treated produced water would have to be known, and perhaps managed by the dairy industry as a 'pasture treatment'.

Food safety programs must include control measures that prevent, eliminate or reduce chemical hazards resulting from chemicals used commonly by farmers themselves.

Equally, any CSG company with wells on a dairy farm must supply the farmers with accurate, up to date and plinformation on any chemicals the company brings onto the farm for CSG purposes, including its measures to prevent, eliminate or reduce hazards, to comply with the farm's food safety program.

The Australian Milk Residue Analysis Survey monitors raw milk for potential presence of agricultural, veterinary and environmental chemical residues. The coordinating agency, Dairy Food Safety Victoria, may need to take account of CSG activities as well.

Disruptions to farm operations

Dairying is more intensive and occurs on generally smaller land holdings than the broadacre cropping and grazing enterprises typical where most CSG development has occurred so far. Dairy's usual activities are also largely inflexible and routine in terms of fixed infrastructure, seasonal cycles and livestock and transport movements.

This means CSG well construction and operation on a dairy property may have a greater physical impact, and involve closer landholder encounters with visiting CSG staff and contractors.

Well pads are generally located in a grid spaced 750 to 1500 metres apart. During drilling and construction, the site footprint may be 50-100m^2. Once built, the majority of the site is rehabilitated, leaving an ongoing production well pad of 5-30m^2.

CSG companies prefer to access wells using existing roads and access tracks, but if this is not possible, they will build new ones. During construction, the right of way may be up to 12m wide, reducing to 7m wide during operation.

Horizontal drilling may be more conducive to intensive farming operations, as it enables pads to be located in less disruptive areas, such as beside a laneway, or in the corner of a turnout paddock.

Farm access

Farmers with CSG wells on their property can expect CSG company and contractor vehicles to visit at least once a month, once the well is built. Vehicles must follow strict weed quarantine controls, and are subject to traffic management plans, as part of land access agreements.

Landowners can expect a work-over rig to be brought on site every one to three years, to clean-out the well and undertake other maintenance. Larger trucks and tankers are usually used, and the process can take two to three days.

Codes of practice

NSW has two mandatory codes of practices for CSG:

- The *NSW Code of Practice for Coal Seam Gas Well Integrity* requires mining titleholders to prepare a non-technical management plan to demonstrate compliance with the code and appropriate management of risks associated with fracking. The Code requires safety management plans, as well as emergency and environmental incident response plans.
- The NSW Code of Practice for Coal Seam Gas Fracture Stimulation Activities stipulates the activities required to manage any associated risks.

NSW has also developed a Draft Code of Practice for Land Access, which will have legislative force.

Queensland has two mandatory codes of practice:

- *The Code of Practice for Constructing and Abandoning Coal Seam Gas Wells and Associated Bores in Queensland, Edition 2.*
- The *Code of Practice for Coal Seam Gas Well Head Emissions Detection and Reporting,* which specifies best practice management procedures to monitor fugitive emissions to ensure compliance with Environmental Authority (EA) conditions.

Both NSW and Queensland have developed Codes of Practice relating to Land Access, to which companies and contractors must adhere. While no landholder can legally refuse access to their property in any State, many mining companies such as Santos and AGL have publicly committed not to enforce their right to access land against a landholder's will.

Conclusion

On-farm issues will need to be addressed on a site-by-site basis. Farming systems, ground and surface water quality and the proposed mining development will all influence options for a particular farm and inform the content of any landholder agreements and compensation.

Some challenges, such as well and aquifer integrity, emissions control, chemical use and produced water treatments, are well-defined and can be effectively managed through the reformed legislative frameworks in Queensland and NSW, including mandatory codes of practice for the mining industry.

Victoria has an opportunity to learn from the evolutionary process experienced in these States.