The Cottage • Bundella Station • Bundella • NSW 2343

13th May 2009

The Secretary

Senate Select Committee on Agricultural and Related Industries

PO Box 6100

Parliament House

CANBERRA ACT 2600

Dear Sir,

Reference Senate Enquiry into Food Production in Australia

Please find my submission regarding this committee's TOR, a précis of which I am willing to give orally to the Committee on 19th May, 2009 at the Shire Council Offices in Gunnedah.

Thank you for your assistance.

Kind regards

Pauline Roberts

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Enc.

How do Australian Farmers provide food that is affordable to consumers, viable for production and of sustainable impact on the environment?

The health of any country that grows adequate food for its own population can be directly linked to the health of the land that produces that food. Effectively, a food's nutritional value in terms of baseline nutrition (ie. minerals) can not rise higher than its source and the nutritional value of that source is directly linked to the quality of the soil, the water and the underlying geology of the region that generated it.

Such a correlation is of course impacted by refining during 'value added' food production, where minerals and other beneficial components contained within the original foods are lost through processing. Indeed, an increasing focus of the processed food industry is now devoted to 'fortified' foods. These are foods in which the minerals and vitamins considered beneficial, but demonstrably lost in refining, or non-existent originally due to deficiencies in soils, are replaced synthetically, eg. folic acid and niacin in flour/breads and iodized salt. There is however growing debate as to whether singled-out, synthetic or substituted forms of minerals and vitamins can accurately and adequately mimic and replace those found in 'real' foods grown on nutrient rich soil with high-quality water. Fortified foods also tend to be more expensive than 'own brand' equivalents. Where fortification is not legislated, any putative benefit offered in these foods is dependent to some degree on the educational understandings of the purchaser in terms of gauging nutritional value and the power of a given-product's advertising.

The link between a food's nutrient density and its ability to contribute to health is not lost on veterinary science where, for the last century at least, diseases caused by mineral deficiencies in animal food rations have been comprehensively documented (1). Veterinary science appears consistently ahead of human medical science in its understanding of such relationships and the use of mineral supplementation is widespread to correct disease, eg. osteoarthritis in lambs caused by a soil/plant copper deficiency. Veterinary evidence exists of 'ill thrift' in cattle herds raised on poor and heavy metal contaminated soils such as rehabilitated mine overburden (2).

Growers, be they of animals, fruit or vegetables are also encouraged to improve or balance their soils, in particular to maintain trace nutrient ratios (eg. boron, zinc, copper) which can be easily lost in high-rainfall environments, or are simply not available in soils with poor intrinsic mineral-holding capacity (eg. sands). To counteract disease and/or loss of production efficiency, committed graziers may also widen/adjust pasture selection since different plants take up and store trace elements in different concentrations at different times of their growing cycle. Ultimately the ease by which this can be achieved without significant, costly inputs can be linked back to the quality of the original soil and the geological conditions that produced it.

The link between nutrient density of foods and disease, reliably demonstrated by animal studies at least, (and increasingly implicated as playing a part in human health (eg. low zinc status and prostate cancer)) suggests that it may be prudent not only to identify high quality soil and water resources in Australia for their sustainable productivity, but also for their special nutritional contribution to plant, animal and human health through quality food production. Well-marketed and better understood, nutrient dense food suppliers may also find their products fetching a premium in the future – similar to that for 'organics' now - both in domestic and export markets. However, this requires understanding of how and why not all foods are created equal rather than the current focus in conventional farming and marketing which is primarily on yield.

Further, should State or Federal governments consider changing the use of land containing high quality soil from food production towards industrial purposes, it would be wise to ensure such development did not affect the nutritional capacity of the soils or water supplies so that they can continue to produce nutrient-dense foods, now and into the future. In the case of Prime Agricultural Lands containing rich volcanic-based soils such as the Liverpool Plains and Gloucester Flats in NSW, the Darling Downs and Haystack Plains of QLD, the high productivity and nutrient density of these soils can be assessed readily within the National Agricultural Monitoring Service (NAMS) database (3).

Unfortunately, not all arable land in Australia is so fortunate to have such geologically 'fresh', mantle-derived parent material for its soil as the Liverpool Plains NSW, let alone its water supplies or relatively stable, high-growth climate. Soil quality is largely determined by the rock from whence it originated (the parent rock) and ensuing 50,000+ years of weathering and its current climate and water holding capabilities. By comparison, soils derived from sedimentary rocks, such as shales and mudstones, tend to be much more concentrated in minerals and other compounds that medical science terms 'anti-nutrients', those which are deleterious to plant, animal and human health (eg. 'heavy metals' such as arsenic, lead, cadmium and uranium). This is due to their formation through deposition, since sedimentary processes tend to concentrate elements. Coal strata are also formed by sedimentary processes, the parent material being anaerobically decomposed plant matter. Sedimentary strata layers of mudstone, shale and coal are often intermingled due to their same geological time of deposition in the lake beds of past millennia.

The poisoning of some 30 million people in the Bangladesh delta in the 1990s, due to water wells dug accidentally into sedimentary strata containing arsenic, is a poignant reminder that we ignore the geology beneath our feet at our peril. The arsenic poisoning that resulted continues to cause skin, bladder and kidney cancers. Today, we recognise the effects of arsenic poisoning as biochemically persistent and showing up as multi-generational - what has been exhumed accidentally is impossible to 'put back'.

However, with the assistance of AusAid, strategies for *tactical* remediation are being studied at the Centre for Environmental Risk Assessment and Remediation at the University of South Australia, but the chronic damage is done and the human cost of this accidental breach of a toxic strata, considerable and long lasting.

Thus, apart from the very real risk of contamination to water supplies by disturbed toxic strata, it should be of particular concern to any food growing area when sedimentary strata are exhumed to the surface because of the potential for contamination of the healthy soil by the toxic anti-nutrients such sedimentary strata contain.

In the case of mining proposed on the Liverpool Plains, coal is another sedimentary strata which contains part-per-million concentrations (= mg/kg) of heavy metals such as lead, cadmium, mercury and arsenic; radioactive metals such as uranium and thorium; carcinogenic organics such as benzene derivatives and excessive amounts of minerals such as manganese, chromium and nickel (4). All of these compounds are identified as being deleterious to human health, with 'safe levels' being regularly reduced by authorities as a better understanding of their human and animal toxicology emerges. Research into the effects of coal material on human, plant and animal health in Australia is astonishingly scarce by comparison even if the danger of its constituents on health is well-known.

Exposure of communities to such constituents is monitored by the Australian Government's National Pollution Inventory (5) and it may be of interest to note that the industrial town of Singleton in The Hunter, NSW, receives 70.3 metric tonnes of heavy and excess metals per year, predominantly from mining operations. By comparison, the agricultural area of Quirindi generates 0.4kg. Further, for context purposes, a single, uncovered, 100-tonne coal wagon, using conservative calculations, contains 1kg of lead as part of its particulate load. (Ref. 4 for CSIRO lead 'fact sheet'.)

The cleanliness of our food supply is receiving increased attention overseas, particularly in Japan and Europe. The European Food Safety Authority (EFSA) (6) recently reduced tolerable weekly intakes (TWI) for another toxic metal, cadmium by 65% to 2.5 µg* per kg of body weight and declared some international food sources would no longer be acceptable. (*µg = 1 millionth of a gram).

Another reason for concern, apart from cadmium's deleterious effect on kidney and bone function, is the impact, even minor heavy metal exposure through ingestion of contaminated foods and/or inhalation of particulate matter, can have on children's growth and behaviour. The risks are magnified for children that are already nutritionally-deprived due to a child's higher metabolic requirements and greater rates of absorption. Should a child already be deficient in a major mineral such as calcium, anti-nutrients such as lead or cadmium can be absorbed to 'fill the gap' temporarily because of their similar electro-biochemical 'fit'. The 'fit' is however neither temporary nor an effective replacement as lead has a half life of 20 years in the body (to prevent damage to excretory organs on excretion) and exerts a catastrophic, disruptive effect on enzyme processes . As successive studies by Needleman et al. in the New England Journal of Medicine, JAMA and Neurotoxic Teratology from 1990 to 2002 have shown (7,8), "*lead acts as an anti-nutrient, hindering the utilisation of calcium, magnesium, zinc and Vitamin B1. High lead levels have been lined to a reduction in IQ, negative classroom behaviour, juvenile delinquency and increased violent behaviour*."

Where strata such as coal are consistently exhumed into surface environments through mining operations, researchers such as Hendryx et.al. (9) from the University of West Virginia have found that the health of 'coal communities' are adversely impacted. These researchers found that coal communities exhibit:

- 70% increase in kidney disease;
- 64% increase in lung disease;
- and 30% increase in hypertension.

Closer to home, the independent Hunter Valley Research Foundation's 2008/09 report into the Newcastle and The Hunter (10) region states in its health segment:

- an increased mortality for people in the Hunter Valley compared to NSW in general;
- a decreased life expectancy for babies born now compared to NSW in general;
- increased rates of lung, skin and colorectal cancer and deaths thereof compared to NSW in general;
- increased rates of death from breast, cervical and prostate cancer compared to NSW in general.

It is often stated by extractive industry proponents that coal and gas mining and agriculture can co-exist. However this convenient view point for the 'status quo' is not consistent with the emerging scientific or consistent anecdotal evidence of those that live that 'co-existence'. Very recently, Queensland graziers have belatedly realised the impact of acute heavy metal contamination on their valuable pasture lands when insufficiently constructed mine tailings dams overflowed onto thousands of productive acres after an 'unexpectedly' high rainfall event. Uptake by plants of toxic minerals is inevitable in high concentrations rendering pastures toxic to stock and their meat unfit for consumption. Uptake by plants and animals can also happen through *chronic* exposure to air-borne contaminants and polluted rain and other water supplies. These anti-nutrients can compete with beneficial nutrients blocking absorption or reduce health of stock and production by poisoning enzyme pathways so that normal metabolic function is impossible to achieve. (2)

Meat and Livestock Australia clearly take a proactive view of ensuring that Australian meat quality is unaffected by chemicals in general through their *Risk Assessment, Livestock Production Assurance audit*

(11). Question 7 clearly states "*Do stock have access to leaking electrical transformers, capacitors, hydraulic equipment or coal mine wastes?*" It discusses polychlorinated biphenyls (PCBs) in this regard, just one of the carcinogenic chemical organic groups present in coal and industrial wastes. It explains that "*PCB residues have been found in soil below leaking electrical transformers....on former coal mining leases and in materials such as coal washery wastes (chitter).*"

One of the disturbing problems with exhumation of sedimentary material is that it continues to generate pollution hundreds of years after mining has stopped, as evidenced by Roman era mines, and other early metal mines in Australia now producing acid mine drainage. The sulphides contained within these strata, often to which the heavy metals are bound, become sulphuric acid on contact with water. The increasingly acidic environment liberates more heavy metals from the component rock and greater amounts of sulphides. This process accelerates until the source rock is depleted, often hundreds of years later.

On the Liverpool Plains, the nutrient-rich alluvium above the rock strata can be tens of metres thick. How is this precious soil to be excluded from acid mine drainage contamination by sedimentary strata and its components during 'unexpectedly' high rainfall events? The Liverpool Plains is a flood plain, where high rainfall events are expected. In the case of open cut mining, 'remediated' piles of overburden are not, and never-will be, equivalent to the Plains' healthy, beneficial, nutrient-dense productive soil. Overburden does not contain a natural drainage system, a multi-generational seed bank or complex subsurface ecosystem. The very nature of this anaerobic strata is anti-life. Overburden is purely metre upon metre of fragmented sedimentary rock, most of which is toxic to all but plants of the lowest orders of succession, most of which are poor and hazardous nutritionally as a food stock, as reference 2 attests.

When it comes to the question of how Australian Farmers should provide food that is affordable, viable for production and of sustainable impact, I am submitting that Prime Agricultural Land can not be sacrificed for industrial development, because no return to its former glory, let alone clean food producing co-existence is possible once toxic strata are breached and exhumed, no matter how close to 'world's best practice' such industries consider their methodologies to be. Aspiring to zero harm, is *not* zero harm.

If we are indeed serious about

- Australia's food quality and the health of our people generated from it,
- our duty of care to provide affordable, clean food to the nation and to those we export to overseas,
- continuing to have access to international markets because our food is demonstrably clean
- and ensuring that highly productive, quality soil and water situated in a beneficial climate can continue to produce uncontaminated food from innovative farming methods for centuries to come

we need to protect such land from wholly inappropriate industrial development. Our food chain, our health, our exports are simply too important to risk to the toxic contamination inevitable from industrial development on the Liverpool Plains.

We would not consider growing food on land that was contaminated with PCBs from old gas works or leaking electrical transformers, so why do we believe, against all the evidence to the contrary, that Liverpool Plains farmers can continue to do so once coal and gas mining is sanctioned?

This time, we literally can not have our cake and eat it too. Unless we are willingly prepared to produce cake that is toxic.

Thank you for your attention to this submission.

Pauline Roberts.

References

(1) eg. *Hungerford's Diseases of Livestock*, McGraw Hill gives a full treatise on mineral deficiencies in animal nutrition and their relationships to disease and lost productivity.

(2) Laboratory Report by NSW Agriculture's Regional Veterinary Laboratory on cattle showing "ill thrift". Cattle were raised on "reclaimed pastures [the] soil was overburden from coal mine". Page 1 of report:

LABORATORY REPORT

NSW Agriculture
Regional Veterinary Laboratory
Woodbridge Road Menangle NSW

Mail - PMB 8 Camden NSW 2570
Telephone : 046 406327
Facsimile : 046 406400

R KEMP
DENMAN/SINGLETON RLP BOARD
98 JOHN STREET
SINGLETON NSW 2330

Phone: 065 72 2944

Our reference

Denman/Singleton RLPB District

Owner Ravensworth via Singleton
Subject Diagnostic testing mineral deficiency copper.

- FINAL report -

HISTORY Suspected: mineral deficiency copper.
Beef cattle (Angus breed). Age mixed. Sex mixed.
Number at risk 150 ; sick 20 ; dead 0 .
Samples sent Thursday 12.6.97, arrived Friday 13.6.97.

Coat colour changed from black - to silver grey. Both cows & calves effected. Calves unthrifty 50kg below expected wt. Condition of cows mostly good. Areas of hair loss. 12 animals had small area of hair loss bilateral on hind leg - about where their tongue would reach. 2 calves had parakeratosis. 2 calves were stiff in hind leg & 'up in pasterns'. Property - Reclaimed pastures Rhodes grass. Soil was overburden from coal mine. As from power station, on pasture. Top dressed with lots of Nitram.

182, 10, 5514

LABORATORY RESULTS

CLINICAL PATHOLOGY

SAMPLE	1	2	3	4	5		Interpretation Deficient	Normal	Elevated
GGT IU/L	24	16	32	22	20		-	<50	>50
AST IU/L	82	84	98	87	68		-	<100	>100
CK IU/L	614	1250	519	274	143		-	<300	>300
Calcium mmol/L	2.22	2.68	2.41	2.50	2.61	Cattle	<2.2	>2.3	-
Magnesium mmol/L	0.94	0.95	1.01	1.01	1.15		<0.7	>0.75	-
Phosphorus mmol/L	2.4	1.5	2.1	2.0	1.7		<1.0	>1.3	-
Copper umol/L	<3	<3	<3	<3	<3		<6	>8.5	

SAMPLE	6	7	8	9	10
GGT IU/L	25	9	21	6	7
AST IU/L	41	47	43	53	50
CK IU/L	243	286	270	305	273
Calcium mmol/L	2.76	2.54	2.92	2.80	2.63
Magnesium mmol/L	0.89	0.94	0.94	0.93	0.95
Phosphorus mmol/L	2.6	3.0	2.2	2.0	2.5
Copper umol/L	<3	<3	<3	<3	<3

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LABORATORY REPORT

SAMPLE	11
GGT IU/L	2
AST IU/L	102
CK IU/L	595
Calcium mmol/L	2.59
Magnesium mmol/L	0.86
Phosphorus mmol/L	2.6
Copper umol/L	<3

Comment: Copper values are based on a caeruloplasmin enzyme analysis.

SAMPLE	1	2	3	4	5	Interpretation: Deficient	Normal	Elevated
GSHPx U/gHb	129	146	121	117	129	Cattle		
						-disease <10	>100	
						-production response <25	-	
						Marginal <100		

CONCLUSION: Confirms copper deficiency

DISTRIBUTION:
R Kemp 065 72 2533
SFVO Maitland

Leslie Reddacliff
for Officer in Charge
18 June 1997

The conclusion is copper deficiency. Cattle were not tested for heavy metal contamination but these anti-nutrients taken up by plants or in water supplies often block absorption of beneficial nutrients by impacting on enzyme pathways through competitive absorption. Pictures of the cattle showing their condition are available if required.

(3) National Agricultural Monitoring System (NAMS) www.nams.gov.au a collection of statistics from government departments. See ABS section for Agricultural commodity classes and values, Geoscience Australia for hydrological maps of Liverpool Plains aquifers, other databases for soil and climate classifications. The Liverpool Plains covers approximately 800,000 acres and its yields of 40% above the national average contributes over $332 million to GDP annually.

(4) The CSIRO's Energy Technology section http://www.csiro.gov.au/org/ETOverview.html and 'fact sheets eg. for lead http://www.csiro.gov.au/resources/LeadInExportCoals.html

The CSIRO provides the 'official' data for the heavy metal compositions of export thermal coals in Australia which has already been washed and mixed with other coals to produce that final analysis. The washing process liberates some of the heavy metals into the water for washing so the analysis is not, as the manager of the database affirms, necessarily representative of the heavy metal loading of the original coal. It is understandable that proving we can reduce the heavy metal contamination in our export coals would be a marketing advantage as our international customers do not wish to burn high mercury, lead, sulphur or arsenic-containing coals in their power plants for fear of contaminating their own countries and having the problem of highly-contaminated residual ash containment. The analysis for domestic coals is not available but it is understood that we burn 'poorer quality' coals domestically and fly ash accumulation from power stations amounts to 7M tonnes per year. Obviously this residual material needs careful storage and handling as it is even more concentrated in toxic anti-nutrients.

Ultimately, coal is not a clean in any sense of the word that most people understand and it can not be made clean since the contaminants are integral to the material itself and its underground environment.

(5) National Pollutant Inventory www.npi.gov.au

(6) http://www.efsa.europa.eu/EFSA/efsa_locale-1178620753812_1211902499464.htm

(7) *Bone lead levels and delinquent behavior*, H. L. Needleman, J. A. Riess, M. J. Tobin, G. E. Biesecker **and** J. B. Greenhouse, Department of Psychiatry, University of Pittsburgh (Pa) School of Medicine, USA, JAMA, 1996 http://jama.ama-assn.org/cgi/content/abstract/275/5/363?maxtoshow=&HITS=10&hits=10&RESULTFORMAT=&fulltext=Bone+lead+levels+and+delinquent+behavior&searchid=1&FIRSTINDEX=0&resourcetype=HWCIT

(8) *Childhood lead poisoning: the promise and abandonment of primary prevention.* H L Needleman, American Journal of Public Health, Vol. 88 Issue 12, 1998 http://www.ajph.org/cgi/content/abstract/88/12/1871

(9) *Relations Between Health Indicators and Residential Proximity to Coal Mining in West Virginia*, Michael Hendryx, PhD and Melissa M. Ahern, PhD., American Journal of Public Health, Vol.98 No4. 2008.

(10) http://www.hvrf.com.au/pages/hrf/hunter_region_yearbook.php

(11) *Risk Assessment – Livestock Production Assurance, on-farm risk assessment for persistent chemicals*. Meat & Livestock Australia, March 2005.