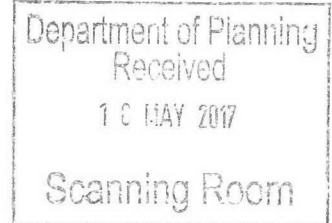


PCU070844

Name: Johanna Evans
Address: 1047 Green Pigeon Rd, NSW, 2474
Date: 10/5/17

Attn: Executive Director,
Resource Assessments Department of Planning and Environment
GPO Box 39
Sydney NSW 2001



This is an objection to the Santos Narrabri Gas both the project itself and the EIS.

Before I begin with my personal submission I would like to point out several problems I had with downloading 7,000 pages of information. To begin with, only 60 days was given by the PAC to deal with a large amount of information. So naturally, I downloaded it straight away, a huge amount of data on a restricted satellite internet connection. Only to discover that the security around the document was so high that it could not be annotated or printed. This caused unnecessary stress and I would suggest in future that the Department checks these things before wasting peoples time and money. In allowing the proponent to even propose this project you are costing people both money and time.

One of the main problems (there are literally hundreds) with this project is that it is harmful to health. Neither the NSW Government nor Santos have investigated or dealt with the serious health effects of coal seam gas now appearing in ENORMOUS amounts of peer-reviewed research in the United States and emerging here in Australia as the truth starts to crack through the research block formed by million dollar industry funded science.

Quote: *"....the potential for harm and the potential of giving a false sense of energy security are often dismissed by its proponents. The process is potentially polluting and damaging not only to human and animal health but also to the environment, as a result of clearing of land for well pads, drilling the wells, extracting the gas, storing the by-products of the extraction, transporting the gas by diesel trucks, and the final capping of the well. THE POTENTIAL FOR HARM TO CHILDREN IS ESPECIALLY WORRISOME."*

<https://www.hindawi.com/journals/isrn/2013/408658/>

<https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-016-2787-5>

COLLATION OF WATER-RELATED SCIENCE AND RESEARCH ACTIVITIES IN THE QUEENSLAND COAL SEAM GAS SECTOR

A total of 188 water-related science and research projects linked to the Queensland coal seam gas sector have or are being carried out by universities, government agencies and coal seam gas (CSG) proponents.

| FUNDING SOURCE | COUNT |
|-----------------------|-------|
| Industry | 129 |
| Industry/government | 8 |
| Government | 37 |
| Government/university | 1 |
| University | 9 |
| Industry/university | 4 |

<http://www.gasfieldscommissionqld.org.au/resources/gasfields/collating-csg-water-related-research-projects-report.pdf>

Under no circumstances SHOULD this project be allowed to go ahead because it cannot comply safely no matter what regulations are put in place. It should be rejected outright by the PAC or harm will occur. The coal seam gas industry cannot operate compliantly in Queensland – just 1 company and their issues is referenced here. CSG is not yet out of nappies in NSW and it is the Government's responsibility to ensure that duty of care is followed. Apply the precautionary principle and say no to this harmful project.

Quote: “The audit, issued in February 2014, detailed widespread compliance problems across Origin’s gas and oilfields in Australia and New Zealand, and gave the division an “unsatisfactory” mark — the second-lowest possible.

<http://www.theaustralian.com.au/business/mining-energy/origin-will-take-years-to-raise-bar-on-compliance/news-story/cf1fd8010692b447cd4b3e577c8cc050>

I completely reject the EIS. It is lacking information across all topics covered and contains misleading and wrong information. It lacks a detailed gasfield infrastructure map including wells, pipelines, water gathering lines, field compression station, HPVS, LPDS, laydown yards etc.

The EIS does not contain any data/assessment of NORMs/radioactivity from coal seam gas activity. This is a glaring omission given the serious nature of radiation exposure to both workers & citizens. Detailed on coming pages.

I reject the EIS due to the catastrophic risk to human health and life and high risk to the ecosystems in the forest. I am not a scientist, I’ll leave the real nitty gritty to the expert submissions and where risk and missing information is referenced I lend my voice and support to those submissions.

Please refer to Ian Sutton’s submission. His submission details breaches of the Australian Constitution. My submission supports his.

The approval process being used for the Narrabri Gas Project’s development application is a breach of section 100 and section 109 of the Australian Constitution.

Australian Constitution

Chapter 4 - Finance and Trade

Section 100 - Nor abridge right to use water

The Commonwealth shall not, by any law or regulation of trade or commerce, abridge the right of a State or of the residents therein to the reasonable use of the waters of rivers for conservation or irrigation.

Chapter 5 – The States

Section 109 - Inconsistency of laws

When a law of a State is inconsistent with a law of the Commonwealth, the latter shall prevail, and the former shall, to the extent of the inconsistency, be invalid.

RISK FOR PROTESTORS & POLICE SHOULD THE PROJECT PROCEED:

Santos do know that there is widespread protester resistance to their plans in the North-west of NSW. If this project is given the go ahead by the NSW government then there is likely to be increased protester activity. The NSW police decided not to police the Bentley protest in the north of the state because of many risks not identified in the document... the one risk mentioned being from litigation: (document snapshot here taken from the actual Police Briefing – verbatim here:)

“Risk to public & police safety (particularly during movements of the 79 heavy vehicles in completion of the installation is high to extreme.) There are many risks identified at that level including the risk of litigation being identified as catastrophic.”

COMMENT:

Metgasco operations were originally scheduled to commence on Monday 31 March, 2014, however was postponed due to inclement weather. Drilling is now anticipated to start in the week commencing 19 May 2014. At this stage a police presence will be required from 18/5/14 – 7/6/14 (this timeframe has been estimated in consultation with Metgasco).

Risk to public and police safety (particularly during movements of the 79 heavy vehicles in completion of the installation) is high to extreme. There are many risks identified at that level including the risk of litigation being identified as 'catastrophic'.

The community ground swell of support is strong and becoming stronger every day. This extends to open support for protestors through the Local Government mayors of the neighbouring LGAs (Lismore, Tweed and Kyogle). The camp presently has approximately 1000 permanent residents, with 100 – 200 visitors per day. This camp site is less than 500 metres from the proposed drilling site. The campsite is on private property. The landowner is fully supportive of the process and is refusing to comply with directions from Richmond Valley Shire Council.

It's highly likely that should Santos pursue this project then the same risks will be present regardless of the new laws.

PROBLEMS WITH SEARS & REQUIREMENTS:

Can the PAC clarify that no political donations have been received as stated by Armon Hicks in the Political Disclosure Statement? This is contrary to what has been reported in the press. The frequency and amount of political donations has to be questioned – if Santos was in fact a legitimate business with a 'social licence to operate' then it would not have to donate so much money to the government. What kind of influence do Santos wish to gain with such large donations?

http://www.lockthegate.org.au/what_influence

Santos don't provide any evidence of the gas actually being recoverable at 200 TJ per day. This is a guess. What if the actual recoverable molecules are only 1/4 of that? Then you've sacrificed a forest for an unsustainable and short-lived resource. Risky gambling?

For this project to be approved on the back of a conceptual map provided by Santos is pure folly. The PAC may as well gift the forest to Santos on a plate and say 'here it is, do what you want with it.' Which they will. If the EIS is approved without detailed mapping of gasfield infrastructure you will no longer have a forest you will have a gasfield. I don't believe that this is a fair swap. I'd prefer a forest.

Baseline data is quoted as being a requirement – in the case of water monitoring data – it does not exist. There is no data prior to fracking by Forceenergy & ESG that occurred early in the 2,000's. Extensive fracks occurred in the Bohena well area, the damage from these fracks, one of which was 'the biggest frack in NSW to date' is unknown. So therefore, data taken from this area now is likely flawed and not representative of a true baseline. To date there is no true baseline water monitoring bores installed in the Pilliga forest (baseline that is untouched by gas activity). Due to natural fluctuations in groundwater chemistry monitoring should have been conducted for many years prior to drilling the first hole. This was never done so this requirement is defunct.

EXECUTIVE SUMMARY:

At the date of publishing the EIS the NSW Gas Plan is incomplete. How can a proponent proceed with an EIS whilst these recommendations have not been satisfactorily put in place?

There is doubt in the community that the Narrabri Gas is actually for NSW with Santos saying it 'could' supply 50% of NSW' gas needs but this figure has differed considerably over the years. Bluescope Steel refrained from signing a contract with Santos because there was too much risk involved. Peter Mitcheley himself is on record in a radio interview saying that there is no guarantee the gas is for NSW:

<http://www.abc.net.au/news/rural/2014-02-21/santos-mou-peter-mitchley/5274974>

Santos are currently experiencing financial difficulties – reported upon frequently in the press – what happens if the company cannot afford to rehabilitate? Who will pay the price of cleaning up the legacy? Seems a big risk?

Community consultation – I have visited the shopfront in Narrabri during business hours 3 times in the past 12 months. Each time the front door was locked and the phone went to message bank. I have written a lengthy letter outlining my concerns, this has received no response to date.

Based on my experience I don't think the statement below can possibly be accurate because the shopfront is never open.

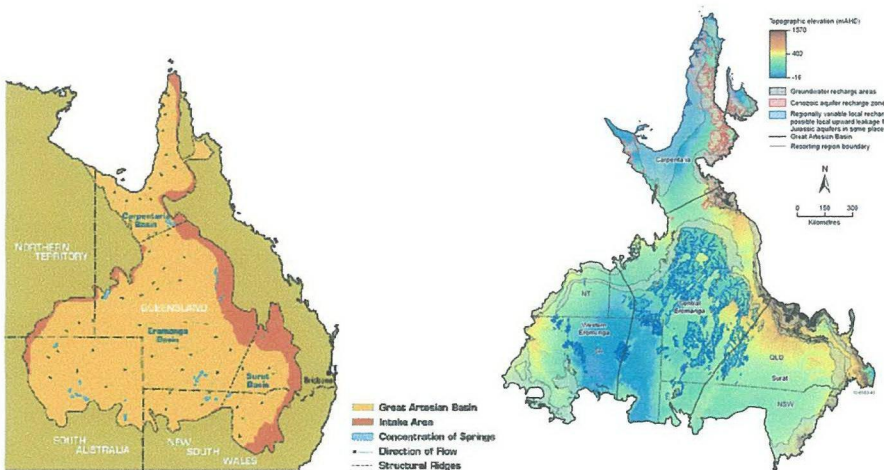
- over 4,000 individual visits to Santos shopfronts in Narrabri and Gunnedah

GREAT ARTESIAN BASIN – GROUNDWATER RISK:

The EIS claims that the project is not located over the recharge zone of the Great Artesian Basin. This is not true. It will cause significant diversion of water from a recharge aquifer of the Great Artesian Basin, which is a water resource relied upon by rural communities across western NSW.

The 0.5m drawdown of water bores in the area is unsubstantiated by Santos and too big a risk to take. There are 3,500-4,500 bores within 30km including Narrabri town water bores relying on Santos to get this right. I don't think the NSW government can afford to allow a private company to take this risk with people's water sources.

<https://narrabrigasproject.com.au/2015/09/the-santos-narrabri-gas-project-will-not-impact-the-great-artesian-basin/>
https://d28rz98at9flks.cloudfront.net/79790/79790_GAB_Atlas.pdf (page 25 onwards)



Induced connectivity between the aquifer and toxic layers by gas wells is assessed by Santos (not consultant) as being low risk but this is Totally Subjective with no data presented. Well integrity failure is well documented in peer reviewed literature:

Dr. Anthony Ingraffea on well casing failure: "Every one of those holes (wells) is a potential conduit for what's happening down there to come to the surface and leak into the air and groundwater."

<https://vimeo.com/102350691>

<https://www.epa.gov/sites/production/files/documents/ingraffea.pdf>

SOCIAL IMPACTS:

Santos have bullied the community into accepting gasfield operations with one example being the threat to

revoke sponsorship of the Narrabri Golf Club if the club agreed to host the Select Committee on Unconventional Gas Mining (Bender Inquiry).

<http://www.news.com.au/national/breaking-news/bullying-claim-over-cancelled-csg-meeting/news-story/8b44050f1ef6c6a3df22b6314bf56a48>

I am deeply concerned about the mental health of the humans (both friends and family) who live in proximity to the Santos unconventional and invasive gas development areas in North-west NSW where Santos have mapped several large gasfields. Self-harm (or the threat of) is becoming more evident in the area, with a local farmer recently voicing his worries to media..

<http://www.abc.net.au/news/2017-04-07/nsw-town-divided-over-coal-seam-gas-proposal/8423394>

Distress is being felt by humans because of the continuation and pursuance of coal seam gas in the region – mental and physical health is at risk because Santos continue to pursue a resource that is known to have grave consequences in regards to human health.

<https://www.google.com.au/url?sa=t&rct=j&q=&esrc=s&source=web&cd=5&ved=0ahUKEwiryqzqo6rTAhUElpQKHxvAZ4QFgg-MAQ&url=http%3A%2F%2Fwww.thechronicle.com.au%2Fnews%2Fdoctor-says-csg-fields-bad-for-kids%2F2504258%2F&usq=AFQjCNHAdSG56mZpObEak3ekbdnq-Xc9Aw>
<http://www.ntn.org.au/wp/wp-content/uploads/2013/12/CSG-Health-Impacts-Dr-W-Somerville.pdf>

Anxiety is felt by both Traditional Owners of the Biliga forest and by the landowners in the surrounding areas because Santos continues to pursue Coal Seam Gas with this project. Anxiety if left untreated can lead to serious mental health issues – suicide/self-harm rates and mental health issues are already climbing in the Barwon electorate and Santos do not need to be adding to these statistics with their activities. I have grave fears that approval of this project will lead individuals to self-harm.

<http://23.101.218.132/prod/parlament/hansart.nsf/V3Key/LA20071115035>

Santos' treatment of peaceful non-violent people who protest their activities leaves me concerned that life threatening injury could occur in the near future, their own contractors have been involved in aggressive acts and in one instance charged by police after throwing eggs and assaulting women (to the best of my knowledge they still employ this contractor named Denis Hardy despite their own guidelines stating that they don't tolerate this kind of behaviour.) They have in the past allowed contractors/employees to be involved with police operations, sometimes using heavy equipment in very close proximity to people, one activist peacefully protesting their operations reports "When the police came they removed all my support crew from the area but Grant {Sergeant Bell, currently under investigation for another matter involving your company} allowed a Santos contractor to stay with me. I believe this person's name is Michael Cooke, but when asked his name, he said "It does not matter," and "Jamie". So I will call him Jamie for this report. Jamie had been threatening me and other peaceful activists on and off for weeks. He had used bolt cutters to cut D locks off the necks of Knitting Nannas. In contravention of WHS regulations, he directed three massive construction vehicles to start work while two quite vulnerable people were locked on inside the facility."

<https://claritygreenwood.wordpress.com>

Santos continually insinuate that detractors of their business are vandalising and thieving from their operations – there is no proof of this – no charges have ever been laid. Their assumptions are clearly misguided. Recent media from industry mouthpiece Energy News Bulletin could only have been fed from Santos Narrabri Office to journalist Anthony Barich in relation to a gas flare being run over by a vehicle. Quote: "It seems to be that time of year for Santos. Police also investigated a March 7, 2016 incident where an estimated \$75,000 worth of equipment was either damaged or stolen at nine Narrabri facilities – including solar panels, batteries, solar generators and security cameras." This kind of divisive anti-protester press is unwarranted and makes the community angry.

<http://www.energynewsbulletin.net/energynewsbulletin/news/1141656/santos-sabotaged-report>

Santos' clear intention to influence government policy against the interests of the majority of the citizens of NSW with the introduction of the 'Santos Law' – emails GIPA'd between Santos & the NSW Government clearly show close collusion between Santos and the government in regards to stemming the stream of legitimate protest through manipulation of law against their business by introducing tough new laws designed to deter people from carrying out their civic duty of protecting land, air & water for future generations.

<http://www.smh.com.au/environment/documents-reveal-close-and-cosy-csg-relationship-between-santos-and-government-20160728-gqfhzg>

Community is clearly distressed! The lengths that good upstanding citizens of NSW will go to to protect their farms, land, heritage and water from invasive mining have not been addressed by Santos.

HEALTH IMPACTS:

A peer-reviewed and published report on the health of full-time residents in CSG areas for the period ending 2011 shows an increase in hospitalisations for cancers and blood/immune diseases in CSG residents. The period 2011-2017 would see an exponential increase in exposures; as the rate of spread of drilling and infrastructure is incremental.

<https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-016-2787-5>

GROUNDWATER: (App F)

Harm has already occurred in the Pilliga forest due to CSG activity (aquifers have been damaged) – this harm cannot be healed, there is no certainty that the underground water systems are not damaged beyond repair from the previous exploration activity of Eastern Star Gas and Forcenergy, and large fracks have occurred, product water has been spilled and dieback areas are becoming more apparent both along Bohena creek and in the forest areas, also, the fragmentation of habitat is a serious threat to the biodiversity of NSW' biggest inland forest.

<http://www.smh.com.au/environment/santos-coal-seam-gas-project-contaminates-aquifer-20140307-34csb.html>

Page 6: http://wentworthgroup.org/wp-content/uploads/2013/12/BREE_Coal-seam-gas-production_WILLIAMS-etal-.pdf

Appendix F and G fail to correctly model the groundwater impacts of Narrabri Gas Project on water users and groundwater dependent ecosystems. Santos EIS claims less than 0.5m drop in Pilliga Sandstone aquifer because there are 'relatively impervious rock layers' between the target coal seam and the aquifer. This is wrong. The Namoi Water Catchment Study Phase 2 by Schlumberger includes this table showing there is no such impervious layer:

Hydrogeological characterisation

Table 7.11 Summary of parameters for each geological unit

| Geological units | Hydrogeological significance | Horizontal hydraulic conductivity, K_h (m/d) | Vertical hydraulic conductivity, K_v (m/d) | Specific yield, S_y (-) | Specific storage, S_s (1/m) |
|------------------------------------|------------------------------|--|--|---------------------------|--------------------------------|
| Narrabri Formation | Significant Aquifer | 0.1 – 30 ^a [6.3] ^a | 0.000001.7 – 0.037 ^a {0.0003 ^a } | 0.005 – 0.1 ^a | 0.000005 ^a |
| Gunnedah Formation | Significant Aquifer | 0.05 – 30 ^a [7.1] ^a | 3.5 to 7.2 ^a | 0.15 ^a | 0.000001 – 0.0005 ^a |
| Lower Namoi / Weathered Horizon | Significant Aquifer | 0.0009 – 8.6 ^a | 0.009 – 0.9 ^a | 0.15 ^a | 0.000001 – 0.0005 ^a |
| Fractured rock horizon | Aquifer | 0.01 – 10 ^a | 0.001 – 0.1 ^a | 0.01 ^a | 0.00001 ^a |
| Great Artesian Basin | Aquifer | 0.004 – 0.265 ^a | 0.000015 – 0.0002 ^a | 0.1 ^a | 0.0001 – 0.0001 ^a |
| Pilliga Sandstone | Aquifer | 0.004 – 0.265 ^a | 0.000015 – 0.0002 ^a | 0.1 ^a | 0.000005 ^a |
| Purlawaugh Formation | Aquifer | 0.004 – 0.02 ^a | 0.000015 – 0.001 ^a | 0.001 ^a | 0.000005 ^a |
| Garrawilla Volcanics | Minor Aquifer | 0.001 – 0.04 ^a | 0.000006 – 0.001 ^a | 0.002 ^a | 0.000005 ^a |
| Napperby and Deriah Formation | Minor Aquifer | 0.001 to 0.04 ^a | 0.000008 to 0.71 ^a | 0.1 ^a | 0.0001 ^a |
| Digby Formation | Minor Aquifer | 0.9 to 1.5 ^a | 0.62 to 0.71 ^a | 0.1 ^a | 0.0001 ^a |
| Upper Black Jack | Aquitard | 0.0003 – 1.1 ^a | 0.19 – 0.59 ^a | 0.1 ^a | 0.00001 ^a |
| Hoskissons seam | Aquifer | 0.13 to 3.3 ^a | 0.00022 to 0.002 ^a | 0.2 ^a | 0.0001 ^a |
| Middle Black Jack | Aquitard | 0.0015 to 0.047 ^a | 0.005 to 0.4 ^a | 0.1 ^a | 0.0001 ^a |
| Melvilles seam | Aquifer | 0.02 ^a | 0.005 to 0.4 ^a | 0.1 ^a | 0.0001 ^a |
| Lower Black Jack | Aquitard | 0.0015 to 0.047 ^a | 0.005 to 0.4 ^a | 0.1 ^a | 0.0001 ^a |
| Watermark and Percupine Formations | Aquitard | 0.0009 – 0.00014 ^a | 0.00009 – 0.0014 ^a | 0.01 ^a | 0.00001 ^a |
| Maules Creek Formation | Aquifer | 0.13 to 3.3 ^a | 0.00022 to 0.002 ^a | 0.1 ^a | 0.0001 ^a |
| Leers Formation | Aquitard | 0.009 – 0.25 ^a | 0.0009 – 0.025 ^a | 0.01 ^a | 0.00001 ^a |

Refs: a = NSW Office of Water (2010), b = Aquaterra (2009), c = Golder Associates (2008), d = Golder Associates (2010), e = GABCC (2010), f = Freeze and Cherry (1979), g = GeoTerra (2008)

ECONOMIC IMPACTS:

The exploitation of State Forest for commercial gain that does not benefit Australians is unconscionable – Santos do not own this land, pay next to nothing for its exploitation and therefore have no right to mine it for

your commercial benefit, also, the recent announcement by Barnaby Joyce (advocate for your business and Minister for Agriculture) is deeply flawed and will also lead to more heartache for farmers.

<http://www.smh.com.au/environment/energy-smart/rise-in-gas-royalties-could-lead-to-windfall-20120106-1pofl.html>

https://www.theguardian.com/environment/2017/mar/17/barnaby-joyce-says-states-should-follow-south-australia-on-coal-seam-gas?CMP=share_btn_tw

GREENHOUSE GAS EMISSIONS:



Coloured chip confirms mulch is at least partly derived from outside materials (not native as Santos have stated).



Salt movement is occurring within the exposed clay horizon.



Surface salts at well site.



Only a few wattle species comprise most of the vegetation at rehabilitated well sites.



Galvanised Burr is common on well sites.



Despite application of gypsum and sulfur, spill sites are still contaminated. Native regen is further inhibited by heavy mulching.

amount of methane and other emissions will cause the quality of the air to be diminished and contribute to climate change – of methane – “It is a powerful greenhouse gas; up to 80 times more powerful than carbon dioxide emissions that are causing most concerns about climate change” says researcher Tim Forcey.

<http://www.abc.net.au/news/2017-02-28/methane-emissions-from-coal-seam-gas-climate-change/8310932>

REHABILITATION:

The

Rehabilitation proposed by Santos in EIS (Appendix V) will not meet their sign-off criteria.

1. Santos have not considered issues with existing sites where rehabilitation has occurred, only a few natives will regenerate, a few eucalypt species and wattles. Very few understorey and grasses have established at the sites. Ongoing weed problems, including Galvanised Burr, Fuzzy weed, Mayne's Curse and African Love Grass are common at all the sites I have visited.
2. No proposal to deal with issues relating to sodicity, alkalinity and salinity which still dog existing legacy sites. Naturally the soils in the forest are acidic (<7pH) explaining why there has been no regeneration of cypress pine at any of the legacy and existing well sites. These issues arise from spillage of produced water at the sites and spillage of-site. While Santos have (ineffective) runoff mitigation measures offsite, there is nothing to stop spillage onsite from occurring in the future.
3. Santos are relying on native regeneration, though there will be only limited seed bank at the well sites. Existing sites have had their top soil removed and Santos are expecting to do the same in the future and either put back the same soil after years of storage or introduce new material. If they put back topsoil while operations are still underway, this soil may be contaminated. Heavy mulching has occurred at all existing sites, also severely hampering natural regeneration.
4. Given the above, to achieve a 75% similarity with control vegetation communities within 5 years for groundstorey plants (the most diverse component) seems unlikely. For canopy species, 75% similarity with natural community is expected after 20 years. But given cypress pine is unlikely to grow under current soil regime, these communities will not be typical communities any time soon.

Santos said in 2013: (see image beneath)

"Santos has always made clear that the rehabilitation of small impacted areas of the Pilliga forest will be addressed prior to our investment in a safe, sustainable project that could deliver in excess of 25% of NSW's gas needs."

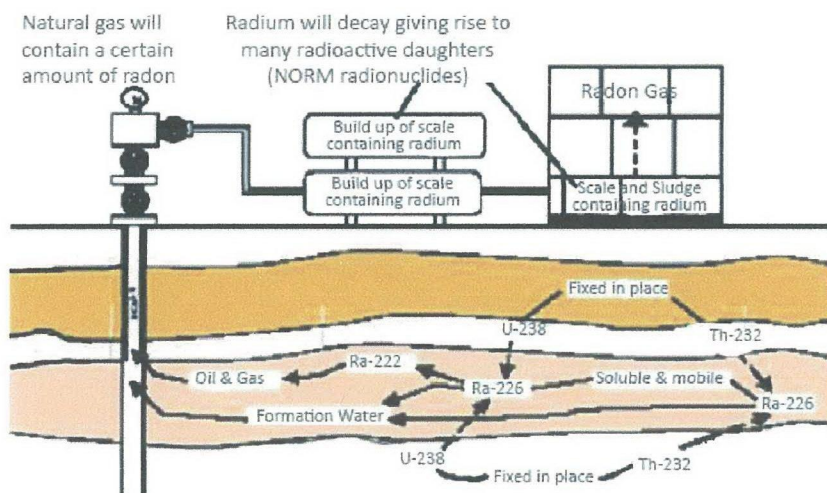


Santos has not and can not rehabilitate the spill zones in the Pilliga forest. Even through aggressive rehabilitation these areas are not responding. In fact the some of the sites are going backwards with dieback areas spreading, despite millions of litres of water being used to try and disperse the toxicity.

RADIOACTIVITY/NORMs

This risk is not assessed in the EIS.

Santos fail to address the occurrence of NORMs/radioactive material encountered downhole and in produced water/solid waste. This is brought to the surface through the well and goes into the waste stream. It can't be removed from the waste stream by reverse osmosis and radioactive gases are emitted into the air.



The article below says – “Environment regulators recommended Santos monitor radioactive elements in its future coal-seam gas operations in the Pilliga Forest despite not seeking such readings once unsafe levels of uranium were found in a contaminated aquifer.”

The EPA's own water quality unit recommended Santos monitor ground water for “radionuclides”, which include thorium, radon and radium.

<http://www.smh.com.au/environment/coal-seam-gas-epa-tells-santos-to-keep-tabs-on-pilliga-radioactive-water-20140311-34kf7.html>

The EPA investigation found that salts, barium and strontium in the produced water in Pond 3 had leaked and contaminated the shallow aquifer, but that the high levels of uranium in the aquifer had not come from the pond! Leachates had apparently mobilised the naturally occurring uranium in the soil. So they provided deniability about the uranium coming from the produced water. However the investigation did say they need to monitor for uranium by products like radon. Why has this not occurred?

Comments from Water Quality Assessment Unit

The EPA requested the Water Quality Assessment Unit within OEH to review the groundwater data received as part of the s101 Notice response. The following comments were provided from the Unit:

The water quality data:

- on satellite photo from Item C indicates that TDS concentrations in shallow aquifers under the NW section of Pond 3 at BWDMMW12S (22,99 mg/L) are similar to TDS concentrations in Pond 3 (30,044 mg/L), and that TDS concentrations at shallow piezometer BWDMMW12 located approximately 50 metres south of these other shallow wells is relatively low at (1690 mg/L).
- in Table 4-4 of the report Hydrogeological Definition Study – Bibbiewindi shows that barium levels in Pond 3 and the shallow piezometer BWDMMW12S at the NW corner of Pond 3 are similar (23.6mg/L and 19.6 mg/L respectively), but barium levels at shallow piezometer BWDMMW12 approximately 50 metres south of these other shallow wells is relatively low (0.261 mg/L).

These water quality results suggest that it is likely that Pond 3 is leaking into the shallow aquifer at or near the NW corner of Pond 3, but further expert opinion or evidence eg on the likely attenuation of pollutants in soil and/or forensic chemical analysis of pond water and groundwater, would be needed to make a more definitive opinion that water pollution has occurred or what has caused any pollution.

Note that Table 4-4 shows elevated nickel and uranium concentrations in BWDMMW1 and BWDMMW12S, but that Pond 3 concentrations were substantially lower suggesting these elements have not been contained in any leakage.

* Santos Bibbiewindi Electrical Survey Technical Report HDPE Geomembrane Liner dated June 2012 and prepared by Phillip Bennett of Geotest Pty Ltd for Santos Limited

The Chief Scientist says that NORMs may be a problem in produced water from some coal formations requiring additional investigation – why has this not occurred?

70,000 mg/L (the latter being about three times the concentration of Cl⁻ in seawater). It is no surprise that salt toxicity is probably the greatest environmental threat posed by produced water and separated solid waste. The pH of produced water is typically strongly alkaline, with ranges of 8–9 being common; such a high pH is highly unusual in Australian streams and would likely have detrimental effects on their biota. Minor and trace elements pose the next greatest threat, with the analytes of concern depending on the formation from which the produced water is derived. The elements magnesium, aluminium, iron, strontium and barium can also pose significant threats in places. NORMs may be a problem in produced water derived from some coal formations, but this requires additional investigation.

The NSW Chief Scientist refers to NORMs and its risk to workers in her report. Why has Santos not addressed this in the EIS?

http://www.chiefscientist.nsw.gov.au/__data/assets/pdf_file/0003/34779/Produced-water-_Gore_Davies_MQU.pdf

NORM elements (radium, radon) typically co-precipitate in the formation of scale minerals in pipes. NORMs are predominantly alpha particle emitters and when concentrated in scale precipitates or in other solids they can present a substantial hazard for gas-field employees. There are no proposed uses for NORM solids, but their safe disposal needs to be addressed. Suggestions have been made to dispose of NORMs in old wells and to distribute them across the land surface. There are no known uses for this material, and disposal or other management of NORMs should be considered in consultation with the Australian Radiation Protection and Nuclear Safety Agency.

Also in her report

Produced-water constituents of concern may include:

- the chemicals used in hydraulic fracturing, and
- waste solids, including suspended precipitate solids (from the formation, corrosion/scale products and bacteria), dissolved solids from the formation water, precipitates (including

NORMs) along the flowpath of the produced water from the coalbed to the surface discharge point, evaporites at the earth's surface, and biotic materials.

The EIS is flawed in this regard, I've spent several days looking for information throughout the some 7,000 pages for any data on NORMs and could find NONE.

Naturally occurring radionuclides are widely distributed in the earth's crust, so it's no surprise that mineral and hydrocarbon extraction processes, conventional and unconventional alike, often produce some radioactive waste.

EPA. TENORM: Oil and Gas Production Wastes [website]. Washington, DC:Office of Radiation and Indoor Air, U.S. Environmental Protection Agency (updated 30 August 2012). Available: <http://www.epa.gov/radiation/tenorm/oilandgas.html> [accessed 8 January 2014].
<http://lconcernedcitizens.org/archives/2715>

Anecdotally, through conducting citizen science in the Pilliga forest area with a Geiger counter I established a background 10 minute count of between 365-410 over several different areas.

On one of my regular trips through the gasfield I came across an area on the road (Beehive Road) that had a foamy caramel coloured material covering it. I had encountered similar material in the Queensland gasfields so I used the Geiger counter to count it and the Geiger returned a reading of 895 – more than double the surrounding background count of 400.

I reported this to the EPA with my suspicion that the material had been dumped on to the road. I was concerned.

The EPA did not attend the site. Samantha Wynn asked me to describe the material to her in a phone conversation – I conveyed my suspicion that it was gasfield waste and that it had come from a vacuum extraction truck contracted to remove the waste from the Santos HPV & LPDs.

Unfortunately as this was my first time dealing with the EPA in the Narrabri area I did not put my suspicions in writing and her response to me was only verbal.

She subsequently communicated that the Geiger counter had been used away from the suspected source so no correlation had been made.

The point I would like to make by relaying this anecdote to the PAC is that the EPA are failing to regulate Santos when it comes to the radioactive element of gasfields. If they were indeed serious about their recommendations then they should have attended this site to do their own testing.

It would seem to me that the EPA are only there to help Santos comply?

This is not the only time I reported raised readings to the EPA over suspected roadside dumping.



Caramel coloured material found on Beehive Road in the Pilliga not far from Santos CSG operation



More of the material found on the road



An image of Namoi waste checking a low point drain in the Pilliga forest

Groundwater Impact Assessment (App F) AQUATIC ECOLOGY (CHAPTER 16) AND GROUNDWATER DEPENDENT ECOSYSTEMS

Key points relating to impacts on aquatic ecology and groundwater dependent ecosystems show some serious flaws with the EIS.

1. Bohen Creek is not generally in poor condition as claimed by Santos. Surveys found while some areas show dieback, most parts of the creek are in a good condition, supporting old growth red gum-rough-barked apple woodlands and many semi-permanent waterholes (about 30) which have a high biodiversity and local significance to wildlife.



Waterhole with old-growth red gum on fringe

2. Hydrological modelling on the impacts of treated water release into Bohena Creek relies on a principle of maximum dilution during periods of high flow but ignores the fact that surface flow can be trapped in creek features and can rapidly sink into the shallow aquifer which underlies the creek system. No assessment has been undertaken on the impact of polluted water within waterholes, which get recharged during periods of high flow.
3. The EIS states that de-pressurisation of aquifers MAY result in a drop of 0.5m, though is likely to increase over time. Even a drop of 0.5m could have significant impacts on the permanence of some waterholes and shallow water tables associated with alluvial areas. However the modelled drawdown impacts on groundwater in the EIS is not credible given lack of supporting data.
4. It seems a stygofauna survey was conducted in a way to minimise the chances of obtaining results, with poor coverage of 'control' areas. Independent surveys as recently as 2013 discovered new species and areas of high diversity. To claim that there will be no impact on stygofauna is not credible given this lack of information and given questions relating to the modelled groundwater drawdown and treated water release.

Stygofauna do live in the Pilliga as noted here:

<http://www.australiangeographic.com.au/news/2013/08/bizarre-new-species-stops-pilliga-mining>

The three new species, two types of mites and one type of worm, are yet to be named. Although they're minuscule (1 mm – 2 mm), they feed on bacteria and help to maintain water chemistry and keep groundwater clean. They also keep flow ways open through their burrowing activities, which then helps surface water, such as rivers and streams, to run smoothly.

5. Invertebrate and fish surveys have been poorly done with no sampling from good condition waterholes on Bohena Creek. The survey missed a key species, the freshwater mussel *Velesunio ambiguus* (pictured below), a strong indicator of good health and permanence of these waterholes. These holes also provide refuge for the native fish, freshwater sponges and a range of invertebrates which rely on good water quality.



6. Santos have contradicted the GDE Atlas by claiming that the only surface groundwater ecosystems in Bohena Creek are a few unidentified waterholes which are in poor condition. The Atlas identifies the creek itself as a GDE, 'moderately dependent upon surface expressions of groundwater', the 30 odd waterholes and the upstream springs are the surface expressions of this system. Overall, this system is currently in a good condition and meets the criteria of being a 'Priority GDE'.
7. Overall, the aquatic and GDE assessments are extremely misleading to the public and should be rejected by both state and Commonwealth consent authorities as being insufficient in detail.

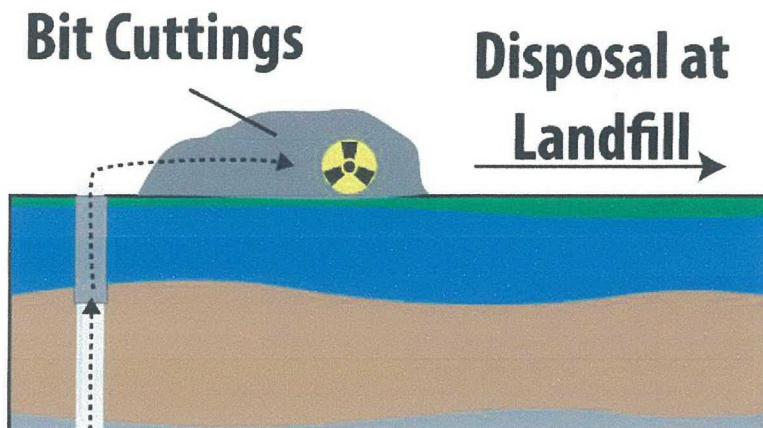
APPENDIX E – DRILLING WASTE LETTER

The EPA does not mention NORMs and how this be managed. Drilling waste is proven to contain NORMs.

CHAPTER 28 – WASTE MANAGEMENT

This chapter has serious flaws & should be rejected by the PAC.

Rock & coal cuttings from the drilling of wells cannot be classified as general waste. Residual radioactivity/ NORMs could be present. This is not addressed by the EIS.



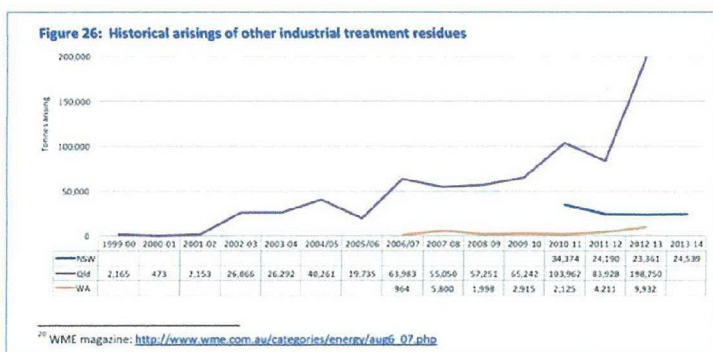
Naturally occurring radioactive materials (NORM) in solid waste or “drill cuttings” produced from unconventional drilling for natural gas extraction wells potentially pose environmental contamination risks
Read more at: <https://phys.org/news/2016-12-additional-radioactive-materials-gas-well-drill.html#jCp>

Brine Disposal & RO Concentrate Disposal

Brine management is a major bottleneck for coal seam gas (CSG) production in Australia. Solid Waste remains, even after 10-15 years of CSG extraction in Queensland, a significant logistics and disposal issue for desalination solid waste and chemical processes.

There is currently no treatment-disposal mechanism in place in Australia for the concentrated (solid salt-waste) produced after the reverse osmosis of CSG brine. This fact will create a legacy issue that the industry will, in all likelihood, pass on to the New South Wales taxpayer.

The Narrabri Gas Project should not be approved based on this issue alone.



CHAPTER 25 HAZARD AND RISK ASSESSMENT

Santos has not properly assessed the major hazards and risks of the project, in that it has incorrectly applied the techniques of EPP33 and HIPAP 4, when the correct legislation it needs to comply with is Chapter 10 of the Work Health and Safety Regulation 2011 – Major Hazard Facilities.

EPP33 and HIPA4 are no longer the relevant legislative standards applicable to major gas/LNG processing

plants in NSW. The correct legislation is the Work Health and Safety Act.

Leewood gas processing plant needs to be regulated as a licensed major hazard facility and undertake safety case assessment as required by the Work Health and Safety regulation 2011. Santos will be handling over 10% of a 'Schedule 15' chemical i.e. methane. In addition, the gas processing equipment, wells, compressor stations will generate air toxics which need to be adequately safety-cased.

This legislation requires notification to WorkSafe NSW, licensing and production of a detailed safety case to ensure onsite and offsite risks to the public, workers, property and the environment are MINIMISED (as low as reasonably practicable).

The tests applied by the guidelines EPP33 and HIPAP4 are INADEQUATE to ensure safety and risk minimisation to the nearby suburbs of Narrabri. It is noted that a primary school, Narrabri West, is within a few kilometres of the active gas field and approximately 10 kilometres from the Leewood gas processing facility.

Santos has not adequately assessed, and as a consequence, not adequately mitigated the risks to the public, workers, plant and the environment of methane explosion, catastrophic toxic untreated produced water loss of containment, catastrophic air toxics cloud production and plant failure such as well blow outs, pipeline rupture, gas processing plant failure, compressor failure etc.

I note that even using the incorrect and out-dated legislative techniques, Santos has identified at least one 'sensitive receptor' 350 metres from the boundary of Leewood at risk from 'uncontrolled containment of gas'.

BUSHFIRE RISK:

Further, Santos has identified a 'moderate' level of bushfire risk with a potential to cause large bushfires. Again, this risk has been subjectively assessed and claimed mitigation measures are un-tested. Santos's own subjective 'risk assessment' may not be acceptable to the surrounding community and inadequate to ensure protection of bushland areas.

AIR TOXICS:

There is no analysis whatsoever of lack of containment of air toxics from either catastrophic or normal operation of the gas processing plant at Leewood.

FLOOD RISK:

Santos has failed to adequately assess the safety of the untreated toxic coal seam gas produced water dams which are proposed to be re-built at Bibblewindi, nor of the risk of flood or loss of containment at the vast Leewood brine storage dams. Both of these areas risk contamination of the Namoi catchment area and the Narrabri town water source.

Below is an image of Leewood facility during a minor flood event that occurred in September 2016:



RISK TO MOTORISTS:

Santos has not assessed the risk to motorists travelling along the Newell Hwy (a busy national Hwy) many of which are travelling at speeds in excess of 110km/hr from the visual distraction of a 50m high flare stack capable of a 30m flame.

FLARING RISKS:

http://www.klmttechgroup.com/PDF/EGD2/ENGINEERING_DESIGN_GUIDELINES_flare_systems_sizing_and_selection_rev_web.pdf

Improper burning of gas resulting in unknown amounts of pollution entering the atmosphere and an explosion risk from colder temps...

<https://www.linkedin.com/pulse/flaring-disasters-flare-stack-failures-mike-trumbature>

Flaring can affect wildlife by attracting birds and insects to the flame. Approximately 7,500 migrating songbirds were attracted to and killed by the flare at the liquefied natural gas terminal in Saint John, New Brunswick, Canada on September 13, 2013.[8] Similar incidents have occurred at flares on offshore oil and gas installations.[9] Moths are known to be attracted to lights. A brochure published by the Secretariat of the Convention on Biological Diversity describing the Global Taxonomy Initiative describes a situation where “a taxonomist working in a tropical forest noticed that a gas flare at an oil refinery was attracting and killing hundreds of these [hawk or sphinx] moths. Over the course of the months and years that the refinery was running a vast number of moths must have been killed, suggesting that plants could not be pollinated over a large area of forest”.[10]

<http://www.cbc.ca/news/canada/new-brunswick/7-500-songbirds-killed-at-canaport-gas-plant-in-saint-john-1.1857615>

That amount of flaring and burning of associated gas from oil drilling sites is a significant source of carbon dioxide (CO₂) emissions. Coupled with fossil fuel combustion and cement production, flaring's carbon dioxide emissions in 2010 have tripled (1300 ± 110 GtCO₂) compared to the last recording (years 1750-1970, 420 ± 35 GtCO₂ had been emitted.)[14] 2400 × 10⁶ tons of carbon dioxide are emitted annually in this way and it amounts to about 1.2 per cent of the worldwide emissions of carbon dioxide. That may seem to be insignificant, but in perspective it is more than half of the Certified Emissions Reductions (a type of carbon credits) that have been issued under the rules and mechanisms of the Kyoto Protocol as of June 2011.[11][15]

<https://www.enviroware.com/modelling-industrial-flares-impacts/>

When a flare operates, it generates noise, heat radiation, and emits atmospheric pollutants. If the combustion is efficient, which means to have a good mixing between the fuel gas and air, the emitted gases are mainly water vapour and carbon dioxide. Even if the combustion efficiency may be higher than 90%, other pollutants are generally present, such as carbon monoxide (CO), nitrogen oxides (NOX), sulphur dioxide (SO₂), volatile organic compounds (VOC) and particulate matter (PM). VOCs derive by incomplete combustion of the flared gas, or by its conversion to other compounds, such as aldehydes or acids. However, VOC elimination is nearly complete, exceeding the 98%. Concerning smoke formation, it is most probable in streams with high carbon/hydrogen mole ratio (greater than 0.35). Some regions of the world are heavily affected by flares pollution (Obia et al., 2011).

Ozone is the key issue - which Santos have admitted in Chapter 18 of EIS - At all stages of gas production, escaping methane can mix with nitrous oxides formed by flares and diesel engines to make ground level ozone. One highly reactive molecule of ozone can burn the deep alveolar tissue in the lungs, causing it to age prematurely. Chronic exposure leads to asthma and chronic obstructive pulmonary disease, and is particularly damaging to the forming lung tissues of young children, active young adults who spend time outdoors and elderly people. Ozone combine with PM₁₀ dust produces smog haze that has been demonstrated to increase hospital emissions in rural areas, especially where people have not been conditioned to the smog of cities (ie their lungs are good). Gasfield ozone is a recognised hazard of natural gas operations and can spread 200 kilometres. It not only causes irreversible damage to the lungs but also to wildlife and vegetation.

FAILURE TO MITIGATE HAZARDS TO ASTRONOMY

Santos has failed to ensure that vital astronomical assets of the Commonwealth of Australia, and 50 other international research institutions, are not detrimentally impacted by the operation of a large gas field and gas processing equipment to the north of Siding Spring.

Over the years, major public funds have been invested in these world class facilities for astronomy. Australian taxpayers and science institutions are rightly deserving of protection of this asset.

There is no recognition of the cumulative impact of future expansion from PEL238 to other gas licence areas much closer to the observatory.

Santos has not proposed adequate mitigation measures to protect the observatory operations, particularly in not ensuring the clarity of the night sky from light pollution impacting negatively on visible light telescopes, and from not preventing an increase in chemical air pollution impacts on delicate instrumentation and mirror surfaces. It has also not recognised or mitigated chemical air pollution impacts on the Narrabri radio telescope facilities.

Santos have failed to propose adequate mitigation measures to minimise the impact of light pollution from flaring operations - in fact, no flare shielding is proposed. Two major flare stacks will likely operate continuously at Bibblewindi and Leewood. Santos has under-estimated the likely continuous operation of these stacks and not proposed adequate shielding.

Santos has under-estimated the amount of light pollution and has contradictory statements in the EIS about the number of flares – at one point it is stated that there will be 'up to 6' (5.3.3) pilot well flares, but in other parts of the EIS it is estimated over 25 pilot flares (Greenhouse Gas Chapter 24) will be operational at any time.

The NSW EPA recommends that flare stacks be shielded. Why is this not accounted for in the EIS?

Appendix Q mentions the potential high light pollution impact of major flare events but minimise the frequency of such events. This is NOT the experience in the QLD coal seam gas fields. The Santos EIS does not reflect practical on the ground experience of coal seam gas field operations.

The reality of gas fields is that gas supply restrictions mean that gas flaring can occur whenever the market is not drawing gas from the Project. This means that flaring can be a constant feature of an operational gas field. Claims by Santos that flaring will be minimal are simply not supportable.

It is inconceivable that the negative impacts of the Project on Siding Spring would be acceptable to Australian and international astronomers nor to the Australian public who have heavily invested in these world class facilities.

I do not consider light and air pollution that will be caused by the Project has been effectively mitigated by Santos' proposed mitigation measures.

Already the Santos gasfield creates more light pollution than the small town of COonabarabran as evidenced by this website: <https://www.lightpollutionmap.info/#zoom=4&lat=5759860&lon=1619364&layers=B0T-FFFFF>



CHAPTER 15 'TERRESTRIAL ECOLOGY':

Following review of Chapter 15 of the Narrabri Gas Project (NGP) Environmental Impact Statement (EIS), a number of serious omissions within the assessment are evident, and several questions regarding the adequacy of the assessment remain unresolved, in particular:

- The adequacy of the methodology used to describe direct impacts is questionable. The lack of a development footprint by which impact could be measured according to 'whole of government' guidelines gives uncertainty to the outcomes.
- Levels of indirect impact have been significantly under-estimated. Using fox predation as a measure, pre-mitigation levels of indirect impact should be at least doubled in magnitude, based on available evidence.
- Survey effort for some key fauna species appears to be deficient and would have adversely affected the ability of the EIS to adequately account some species.
- A NSW and Commonwealth-listed threatened ecological community White Box Blakely's Red Gum-Yellow Box Woodland (and derived native grassland) has been mis-identified and presumed to be not present in the study area. New data confirms its presence along Bohena Creek.
- The description of important habitat for a number of key fauna, such as the Regent Honeyeater, Pilliga Mouse, Koala, Black-striped Wallaby and Five-clawed Worm-skink does not appear to be accurate.
- New information regarding the presence of the Koala in the study area discounts the assertion made in the EIS that it is not currently present.
- Due to deficiencies in the in the survey and assessment for two 'matters for further consideration' (Regent Honeyeater and Five-clawed Worm-skink) statutory requirements under the NSW Biodiversity Offset Policy have not been met.
- Direct impacts upon Brigalow Park State Conservation Area remains uncertain as do the magnitude of indirect impacts upon the adjacent Nature Reserve and existing corridors.
- A Biodiversity Offset Strategy does not provide any surety for how well it will 'retire' the impact of the Project because the strategy provided in the EIS does not provide any like-or-like land-based offsets apart from an unproven rehabilitation plan and rests on the hypothetical efficacy of a feral animal control proposal. The suitability of the offset package with respect to the statutory requirements under the NSW Biodiversity Offset Policy is poor.

AIR POLLUTION – Chapter 18

The air pollution assessment is unsatisfactory.

The EIS consequence modelling assumes the gas composition is 100 per cent methane.

2.3.6 Gas composition

Gas composition will vary between wells and throughout a well's life. For the purpose of consequence modelling, it has been assumed that all gas is 100 percent methane. This represents the most conservative assessment approach.

It's not good enough for an EIS to say that it will vary. How will it vary? With what components? Santos' own gas comp data shown here says there are other components and if this information is known then why is the EIS based on assumptions?

It comprises methane, ethane, butane, and some higher hydrocarbons that can form ozone smog in sunlight, especially mixed with flaring combustion products like nitrous oxide. There is also hydrogen sulphide. This air pollution is not documented in the EIS by Santos.

GAS COMPOSITION ANALYSIS

| Well | Sample Details | | | | | | Air-Corrected Gas Composition | | | | | | | | | | Total | Calculated Gas Density (Air = 1) | Calorific Value | | Average Molecular Weight | Air Content % | | |
|---------|----------------|-------|----------|-----------|-------------|-------------------------|-------------------------------|---------------------|------|----|-----------------|-----------------|-------------------------------|-------------------------------|----------------------------------|----------------------------------|-------|----------------------------------|----------------------------------|--------------|--------------------------|---------------|------------|-------|
| | Date | Time | Sample # | Source | Well Status | Sample Point | N ₂ MOL% | O ₂ MOL% | Ar | CO | CO ₂ | CH ₄ | C ₂ H ₆ | C ₃ H ₈ | i-C ₄ H ₁₀ | n-C ₄ H ₁₀ | | | n-C ₅ H ₁₂ | Gross Btu/lb | | | Net Btu/lb | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| BH0002 | 20-Apr-98 | 0:00 | - | Hokkison | Drilling | Coal core @ 640m | 5.80 | | | | | 15.63 | 78.21 | 0.16 | 0.11 | | | | 100.00 | 0.732 | 799 | 719 | 21.192 | 45.43 |
| BH0002 | 30-Apr-98 | 0:00 | - | Hokkison | Drilling | Coal core @ 679m | 2.40 | | | | | 14.28 | 82.02 | 0.09 | 0.09 | | | | 100.00 | 0.754 | 840 | 756 | 20.402 | 16.29 |
| BH0002 | 09-May-98 | 14:20 | - | Digby Set | Drilling | DST #6 | 10.12 | 0.20 | | | | 1.70 | 87.17 | 0.07 | 0.04 | | | | 100.00 | 0.814 | 883 | 795 | 17.295 | 0.27 |
| BH0002 | 17-May-98 | 0:00 | - | Mauls Ck | Drilling | Coal core @ 877m | 1.79 | | | | | 6.26 | 91.63 | 0.14 | 0.08 | | | | 100.00 | 0.641 | 907 | 816 | 18.897 | 27.67 |
| BH0002 | 19-May-98 | 0:00 | - | Mauls Ck | Drilling | Coal core @ 590m | 1.75 | | | | | 1.49 | 91.77 | 0.06 | 0.08 | | | | 100.00 | 0.818 | 383 | 345 | 23.705 | 15.34 |
| BH0002 | 06-Jun-98 | 13:00 | - | Mauls Ck | Cavitating | Car-choke man separator | 92.96 | 9.11 | | | | 1.84 | 22.11 | 0.01 | 0.00 | | | | 100.00 | 0.678 | 731 | 658 | 19.269 | 1.19 |
| BH0002 | 17-Jul-98 | 8:45 | - | Mauls Ck | Producing | | 13.19 | 0.23 | | | | 2.13 | 86.32 | 0.08 | 0.00 | | | | 100.00 | 0.653 | 794 | 715 | 18.919 | 1.29 |
| BH0002 | 24-Jul-98 | 13:00 | - | Mauls Ck | Producing | | 20.44 | 0.24 | | | | 2.05 | 92.19 | 0.08 | 0.00 | | | | 100.00 | 0.668 | 782 | 704 | 19.047 | 0.00 |
| BH0002 | 28-Jul-98 | 13:00 | - | Mauls Ck | Producing | | 23.23 | 0.24 | | | | 2.12 | 90.86 | 0.04 | 0.00 | | | | 100.00 | 0.659 | 780 | 703 | 19.055 | 0.00 |
| BH0002 | 31-Jul-98 | 9:00 | - | Mauls Ck | Producing | | 20.03 | 0.23 | | | | 8.33 | 72.34 | 0.01 | 0.00 | | | | 100.00 | 0.712 | 733 | 660 | 20.330 | 0.78 |
| BH0002 | 05-Aug-98 | 8:30 | - | Mauls Ck | Producing | | 23.58 | 0.24 | | | | 6.31 | 83.22 | 0.15 | 0.00 | | | | 100.00 | 0.660 | 787 | 707 | 19.102 | 0.20 |
| BH0002 | 09-Aug-98 | 9:10 | - | Mauls Ck | Producing | | 19.22 | 0.24 | | | | 2.28 | 77.69 | 0.01 | 0.00 | | | | 100.00 | 0.652 | 794 | 715 | 18.888 | 1.07 |
| BH0002 | 16-Aug-98 | 18:00 | - | Mauls Ck | Cavitating | | 11.81 | 0.24 | | | | 1.63 | 78.34 | 0.01 | 0.00 | | | | 100.00 | 0.615 | 948 | 852 | 17.830 | 87.17 |
| BH0002 | 20-Aug-98 | 10:00 | - | Mauls Ck | Cavitating | | 0.96 | 0.25 | | | | 0.99 | 82.30 | 0.09 | 0.00 | | | | 100.00 | 0.728 | 636 | 573 | 21.040 | 72.60 |
| BH0002 | 23-Aug-98 | 0:00 | - | Mauls Ck | Cavitating | | 25.33 | 0.24 | | | | 6.19 | 72.05 | 0.01 | 0.00 | | | | 100.00 | 0.670 | 738 | 653 | 19.140 | 1.14 |
| BH0002 | 30-Oct-98 | 13:36 | 1009 | Mauls Ck | Producing | | 24.48 | 0.19 | | | | 0.58 | 74.27 | 0.01 | 0.00 | | | | 100.00 | 0.654 | 753 | 678 | 19.237 | 1.08 |
| BH0002 | 07-Nov-98 | 15:00 | 1020 | Mauls Ck | Producing | | 21.89 | 0.13 | | | | 0.15 | 77.16 | 0.07 | 0.00 | | | | 100.00 | 0.646 | 788 | 709 | 18.701 | 0.46 |
| BH0002 | 30-Nov-98 | 10:00 | - | Mauls Ck | Producing | | 24.89 | 0.04 | | | | | | | | | | | 100.00 | 0.759 | 734 | 661 | 21.900 | 0.14 |
| BH0002 | 23-Feb-99 | 16:10 | 1059 | Mauls Ck | Producing | | 10.68 | 0.04 | | | | 16.51 | 72.39 | 0.07 | 0.00 | | | | 100.00 | | | | | |
| BH0002D | 02-Sep-99 | 12:05 | - | Digby Set | Shut in | Csg | 11.04 | 0.25 | | | | 1.67 | 86.94 | 0.08 | 0.00 | | | | 100.00 | 0.615 | 861 | 790 | 17.815 | 0.46 |
| BH0002D | 10-Sep-99 | 19:20 | - | Digby Set | Shut in | Csg | 11.30 | 0.27 | | | | 1.66 | 86.99 | 0.08 | 0.00 | | | | 100.00 | 0.616 | 859 | 791 | 17.839 | 0.46 |
| BH0002D | 14-Sep-99 | 11:35 | - | Digby Set | Shut in | Csg | 10.28 | 0.13 | | | | 2.06 | 86.94 | 0.06 | 0.00 | | | | 100.00 | 0.701 | 618 | 611 | 20.290 | 1.92 |
| BH0003 | 29-Sep-99 | 14:00 | - | Mauls Ck | Producing | Csg | 3.99 | 0.25 | | | | 5.59 | 90.04 | 0.12 | 0.00 | | | | 100.00 | 0.694 | 913 | 822 | 18.067 | 0.27 |
| BH0003 | 30-Oct-99 | 15:15 | 1012 | Mauls Ck | Producing | Csg | 2.50 | 0.18 | | | | 19.79 | 76.92 | 0.10 | 0.00 | | | | 100.00 | 0.758 | 782 | 704 | 21.598 | 0.09 |
| BH0003 | 30-Nov-99 | 9:20 | - | Mauls Ck | Producing | Csg | 3.63 | 0.10 | | | | 6.11 | 89.80 | 0.10 | 0.00 | | | | 100.00 | 0.633 | 907 | 816 | 18.348 | 0.09 |
| BH0003 | 23-Feb-99 | 15:58 | 1059 | Mauls Ck | Producing | Csg | 35.35 | 0.15 | | | | 4.00 | 60.31 | 0.07 | 0.00 | | | | 100.00 | 0.739 | 612 | 551 | 21.398 | 0.00 |
| BH0004 | 06-Jul-98 | 0:00 | - | Mauls Ck | Drilling | Coal core @ 647m | 0.57 | | | | | 9.10 | 90.22 | 0.11 | 0.00 | | | | 100.00 | 0.645 | 915 | 824 | 18.676 | 25.94 |
| BH0004 | 06-Jul-98 | 6:00 | - | Mauls Ck | Drilling | Coal core @ 663m | 7.29 | | | | | 3.16 | 72.80 | 0.02 | 0.00 | | | | 100.00 | 0.800 | 234 | 211 | 25.770 | 17.46 |
| BH0004 | 24-Aug-98 | 11:30 | - | Mauls Ck | Producing | Csg | 47.16 | 0.13 | | | | 2.11 | 50.53 | 0.07 | 0.00 | | | | 100.00 | 0.769 | 513 | 481 | 20.273 | 3.20 |
| BH0004 | 08-Sep-98 | 13:30 | - | Mauls Ck | Producing | Csg | 29.12 | 0.11 | | | | 4.80 | 65.83 | 0.05 | 0.00 | | | | 100.00 | 0.721 | 688 | 601 | 20.885 | 2.15 |
| BH0004 | 30-Oct-98 | 14:45 | 1011 | Mauls Ck | Producing | Csg | 30.03 | 0.14 | | | | 2.29 | 67.43 | 0.16 | 0.00 | | | | 100.00 | 0.701 | 687 | 619 | 20.311 | 1.92 |
| BH0004 | 07-Nov-98 | 14:40 | 1019 | Mauls Ck | Producing | Csg | 24.63 | 0.09 | | | | 4.23 | 73.83 | 0.10 | 0.00 | | | | 100.00 | 0.698 | 721 | 649 | 20.219 | 1.61 |
| BH0004 | 23-Feb-99 | 16:30 | 1060 | Mauls Ck | Producing | Csg | 24.30 | 0.16 | | | | 2.12 | 73.50 | 0.09 | 0.00 | | | | 100.00 | 0.674 | 746 | 671 | 19.514 | 1.39 |
| BH0005 | 29-Sep-98 | 17:00 | - | Mauls Ck | Flowing | Csg | 13.10 | 0.17 | 1.11 | | | 37.75 | 42.16 | 0.11 | 0.00 | | | | 100.00 | 0.970 | 483 | 435 | 28.080 | 7.81 |
| BH0005 | 07-Oct-98 | 15:20 | - | Mauls Ck | Flowing | Csg | 5.57 | 0.35 | 1.99 | | | 29.07 | 62.66 | 0.16 | 0.00 | | | | 100.00 | 0.848 | 643 | 579 | 24.564 | 3.42 |
| BH0005 | 07-Oct-98 | 15:30 | - | Mauls Ck | Flowing | Csg | 4.60 | 0.39 | 1.35 | | | 24.65 | 68.94 | 0.16 | 0.00 | | | | 100.00 | 0.804 | 704 | 634 | 23.278 | 3.80 |
| BH0005 | 30-Nov-98 | 11:00 | - | Mauls Ck | Producing | Csg | 16.68 | 0.21 | | | | 6.44 | 77.10 | 0.17 | 0.00 | | | | 100.00 | 0.682 | 783 | 705 | 19.796 | 8.81 |
| BH0006 | 10-Feb-99 | 19:55 | 1042 | Mauls Ck | Producing | Csg | 53.35 | 0.10 | | | | 2.62 | 43.87 | 0.25 | 0.01 | | | | 100.00 | 0.800 | 445 | 401 | 23.152 | - |
| BH0006H | 30-Oct-98 | 15:30 | 1013 | Hokkison | Producing | Csg | 14.44 | 0.16 | | | | 13.65 | 71.68 | 0.04 | 0.00 | | | | 100.00 | 0.748 | 728 | 625 | 21.603 | 4.81 |
| BH0006H | 30-Nov-98 | 11:45 | - | Hokkison | Producing | Csg | 6.16 | 0.11 | | | | 15.69 | 77.40 | 0.02 | 0.00 | | | | 100.00 | 0.733 | 784 | 705 | 21.233 | 0.31 |
| BH0007 | | | | | | | | | | | | | | | | | | | | | | | | |
| WP0001 | 03-Apr-98 | 17:50 | - | Periscene | Flowing | Csg | 22.81 | 0.44 | | | | 1.95 | 74.90 | 0.26 | 0.00 | | | | 100.00 | 0.666 | 765 | 669 | 19.208 | 0.41 |
| WP0001 | 04-Apr-98 | 13:45 | - | Periscene | Flowing | Csg | 29.58 | 0.43 | | | | 2.61 | 74.95 | 0.27 | 0.00 | | | | 100.00 | 0.666 | 763 | 667 | 19.302 | 0.40 |
| WP0001 | 05-Apr-98 | 14:15 | - | Mauls Ck | Flowing | 1bg | 27.47 | 0.42 | | | | 4.68 | 72.68 | 0.26 | 0.00 | | | | 100.00 | 0.686 | 745 | 610 | 19.525 | 0.50 |
| WP0001 | 24-Oct-98 | 16:40 | - | Periscene | Flowing | 1bg | 21.19 | 0.45 | | | | 2.23 | 75.78 | 0.29 | 0.00 | | | | 100.00 | 0.654 | 774 | 697 | 19.218 | 0.50 |
| WP0001 | 24-Oct-98 | 16:45 | - | Periscene | Flowing | 1bg | 21.21 | 0.44 | | | | 2.23 | 75.28 | 0.29 | 0.00 | | | | 100.00 | 0.654 | 775 | 698 | 19.236 | 0.50 |
| WP0001 | 30-Oct-98 | 16:35 | 1014 | Combined | Producing | Csg | 21.97 | 0.45 | | | | 2.31 | 74.26 | 0.28 | 0.00 | | | | 100.00 | 0.658 | 768 | 690 | 19.341 | 0.50 |
| WP0001 | 07-Nov-99 | 13:50 | 1010 | Combined | Producing | Csg | 24.99 | 0.46 | | | | 2.20 | 74.52 | 0.27 | 0.00 | | | | 100.00 | 0.658 | 768 | 690 | 19.341 | 0.50 |
| WP0001 | 13-Nov-99 | 11:00 | 1022 | Combined | Producing | Csg | 24.70 | 0.46 | | | | 2.26 | 75.96 | 0.13 | 0.00 | | | | 100.00 | 0.657 | 768 | 690 | 19.310 | 0.50 |
| WP0001 | 30-Nov-99 | 9:30 | - | Combined | Producing | Csg | 21.20 | 0.45 | | | | 2.10 | 75.95 | 0.29 | 0.00 | | | | 100.00 | 0.653 | 775 | 698 | 19.194 | 0.50 |
| WP0001 | 11-Feb-99 | 7:30 | 1043 | Combined | Producing | Csg | 25.50 | 0.42 | | | | 2.11 | 75.90 | 0.27 | 0.00 | | | | 100.00 | 0.663 | 771 | 694 | 19.620 | 0.50 |
| WP0001 | 23-Feb-99 | 15:30 | 1061 | Combined | Producing | Csg | 21.37 | 0.45 | | | | 2.44 | 75.47 | 0.27 | 0.00 | | | | 100.00 | 0.656 | 770 | 693 | 19.282 | 0.50 |
| WP0003 | 11-Feb-99 | 8:20 | 1044 | Mauls Ck | Flowing | Csg | 98.63 | 0.05 | | | | 0.35 | 7.95 | 0.01 | 0.00 | | | | 100.00 | 0.936 | 81 | 73 | 27.104 | 0.00 |
| WP0003 | 17-Feb-99 | 15:00 | 1062 | Mauls Ck | Producing | Csg | 20.17 | 0.05 | | | | 4.10 | 30.35 | 0.03 | 0.00 | | | | 100.00 | 1.103 | 309 | 277 | 31.951 | 0.00 |
| WP0003 | 23-Feb-99 | 15:10 | 1063 | Mauls Ck | Producing | Csg | 15.99 | 0.07 | | | | 51.74 | 33.65 | 0.06 | 0.00 | | | | 100.00 | 1.134 | 311 | 200 | 32.844 | 0.00 |
| WP0004 | | | | | | | | | | | | | | | | | | | | | | | | |
| WP0005 | | | | | | | | | | | | | | | | | | | | | | | | |

CONCLUSION:

'The project is too risky, based on poor information, questionable details, omitted information, incorrect data, out of date information, flawed methodology, assumed figures, unanswered or ignored concerns and lack of detail.

Santos have clearly not addressed adequately the problems that I have list above and for these reasons I object to this proposal and ask that the project EIS be rejected.

We have come to a point now in the history of humankind whereby if we do not address our progress and choose more sustainable energy sources to support our endeavours then we will become extinct.

I don't believe that this project fits that bill and it should be rejected outright and the company advised to take action to change its path to more sustainable operations that will benefit all of New South Wales.

I'm not keen to see the good people of NSW go to jail for doing their civic duty of protecting land, air & water for future generations from rapacious and greedy companies such as Santos. Do the right thing and deny approval to this dangerous project.



Mary O'Kane
The NSW Chief Scientist
on Coal Seam Gas

"The risk to human health and the environment posed by coal seam gas can be managed but 'unintended consequences' due to accidents, human error and natural disasters are inevitable."

#SantosCSGTooRisky