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Attention:

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

The target for my submission is the Narrabri Gas EIS.

I strongly OBJECT to this proposal and recommend that it should be rejected.

Background.

My Ph.D. is in Chemistry and I have worked in industry analysing boiler water for saline contamination, the presence of which would identify boiler tube failure.
I have been elected Chairperson of Occupational Health and Safety Committees for two major tertiary institutions and am experienced in risk management strategies.

Justification for my Objection

1. Corrosion of Iron and Steel

Iron and steel, in the presence of water, oxygen and saline catalysts, will readily oxidise the iron component of steel alloys. (This was demonstrated recently when a local swimming pool was forced to close following boiler failure and more recently by the corrosion of its old steel filter bowl. Corrosion over time has predictably destroyed the integrity of the pool's infrastructure. Presently, the old plant is being replaced.)

Corrosion of iron and steel is a predictable, natural occurrence. Protective coverings such as paint, galvanising, concrete shielding and sacrificial electrodes, without regular maintenance, reapplication, and replacement, will only delay corrosive failure. (i.e. **Iron and steel plant and its infrastructure will fail at some time in the future.**) The Narrabri Gas EIS contains no plan for maintenance of plant and replacement of equipment and infrastructure beyond the projected life of the project.

The limitation of the maintenance of plant, equipment and infrastructure for the projected extraction period of the Narrabri Gas EIS exemplifies the proposed procedure is flawed necessitating the project to be rejected.

2. Planned siting of wells is incomplete

The Narrabri Gas EIS does not include a detailed well site plan for the entire field. Without this plan Santos is in no position to evaluate, *a priori*, the personal, social and environmental, affects of their proposed EIS.

The Narrabri Gas EIS is incomplete and should be rejected.

3. **Rock strata above the coal seam will be fractured**

The planned wells in the Narrabri Gas EIS will pass through several different rock strata. Each layer possesses different properties, porosity, water content and pressures. All layers above the targeted coal seam must be breached to enable access to the desired coal seam. The integrity of each of these layers, including the significant recharge conduit for the Great Artesian Basin, and the capping layer retaining the coal seam gas within the coal seam, will be breached. Faulting is present in the Jurassic and Permian deposits. Santos acknowledges the risk, although its significance is played down, in the Narrabri Gas EIS (Santos, 2017(a)).

When pressurised fracking occurs, not only is the coal seam split, liberating the adsorbed coal seam gas, but the isolating cap rock and the rock layers it supports will also fracture, permitting interchange of liquids and gases between the rock layers and the ground surface.

a. **Effect on liquid retention**

Mixing of waters between the surface, subterranean aquifers and coal seams will occur as waters percolate through the fractured rock strata. Contamination of the surface, each aquifer, and the coal seam will result.

b. **Effect on gaseous movement**

The pressurised coal seam gas will be forced upwards along the pressure gradient towards lower surface pressures. Contamination of the surface, each aquifer, and the coal seam by fugitive gas is a predictable and significant outcome.

c. **Effect on surface environment**

Fugitive gas and liquids, as well as solid and liquid spills, are spread by wind, rain and physical movement (e.g. truck tyres). Surface soil, water and aquifers will be contaminated. Fugitive gas will infiltrate and contaminate the local atmosphere.

d. **Effect on environmental (including human) health**

The release of fugitive gas and waters from the coal seam will contaminate all subterranean and surface aquifers, soils and the atmosphere. Fugitive gas contains carcinogens, teratogens and other poisonous substances, which will affect humans, other animals, plants, bacteria and viruses.

The methodology of the Narrabri Gas EIS is unsafe and should be rejected.

4 **High Spill Rates during pilot Study**

Santos has reported 20 spills from only 50 wells sunk during the pilot plant stage conducted in the Pilliga State Forest. The escape of 'Produced Water' from these spills contaminates the surface soils with foreign chemical substrates and concentrations. Some of these contaminants would be deliberately added to the well by the company, others would be released from within the pressurised, fractured coal seam. These contaminants may include carcinogens, teratogens, and poisonous substances, such as benzene, toluene, xylene, ethyl benzene, uranium compounds, lead compounds and cadmium compounds.

If 5% of wells are predicted to leak in the first year, and all others to fail sometime into the future, the procedure cannot be safe. A failure risk of 100% is totally unacceptable.

These spill figures demonstrate that Santos does not have the competence to manage 50 wells safely. One must question how Santos would be competent to manage an extended number of 850 wells, safely.

Santos' demonstrated management incompetence, confirms the Narrabri Gas EIS should be rejected.

5. MSDS

The Narrabri Gas EIS lists a number of substances Santos proposes to use in its drilling and fracking programmes. I have been unable to find MSDS for these and other substances when applied to their particular process for which they have been selected. Without appropriate MSDS details for each substance as used, the safety of each chemical cannot be determined. These chemicals cannot be assumed safe.

The Narrabri Gas EIS is incomplete and unacceptable and should be rejected.

6. Water draw-down

The Narrabri Gas EIS has acknowledged water drawdown will occur 'up to 0.5m' (Santos, 2017(a)), following produced water loss and the removal of CSG from the Narrabri Field. Santos (2017(b)) predicts a maximum Early Permian drawdown of 153m and Late Permian drawdown of 16.4m. Appendix F claims the Great Artesian Basin will only experience a drawdown of <0.5m, similar to the water table prediction. The water table and Great Artesian Basin figures seem inconsistent with the Permian predictions. I have been unable to justify these figures from the limited data available in Appendix F.

Any lowering of the water table will affect both agricultural use of the land as well as forest growth. When the water table drops below the depth required to support root growth, all dependent plant life will be affected. It is predictable that such action would jeopardise the nationally significant 'food bowl' in Santos's proposed project area. The plant communities in the Pilliga State Forest, as well as dependant animals, some of which are critically endangered, will also be negatively affected. The EIS claims two endangered species will be affected but appears to ignore other species in the Pilliga State Forest, and elsewhere in the project area (Santos, 2017(c)).

The Nationally and State significant food bowl, Pilliga State Forest and other plant communities are dependent on water for survival. Without more stringent justification of a stable water table I urge you to reject the Narrabri Gas EIS application.

Summary

The proposed extraction procedure is flawed and designed to fail. Planned sitings of wells and MSDS provisions are incomplete. Corrosion of proposed plant and infrastructure will ensure the failure of 100% of wells over time. Contamination of, and reduction in recharge capacity of the aquifer feeding the Great Artesian Basin, will occur. The drilling and fracking process will fracture the cap rock and higher strata permitting fugitive gas escape to the surface. Water mixing and contamination of all aquifers will occur. The predicted small surface water drawdown is unjustified in the EIS. Any drawdown will impose a future change in land use for this 'food bowl'. The Pilliga State Forest will itself be endangered, as will its already endangered species. High spill rates from the pilot project question Santos' competence in conducting a significantly extended gas field. The proposed Narrabri Gas field appears inappropriately selected, and researched and the EIS incompletely prepared.

Executive Director, from within my area of expertise, I have addressed six pivotal issues and found each to propose unacceptable risks to humans, other animals, plants, water, land and air environments, the region, state and nation. Each is sufficient to demand refusal of the Narrabri Gas EIS proposal.

I urge you to recommend to the Government the rejection of the Narrabri Gas EIS.

References

- Santos, 2017(c) Narrabri Gas EIS, Chapter 4, *Section 4.6.1*, page 31-32
Santos, 2017(a) Narrabri Gas EIS, Chapter 12, *Section 12.4.2*, page 12-23
Santos, 2017(b) Narrabri Gas EIS, Appendix F, *Sections 8-9*

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