Submission on the Narrabri Gas Project

May 2017

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Healthy planet, healthy people.

Submission to the New South Wales Government Department of Planning and Environment on the Narrabri Gas Project.[1]

Doctors for the Environment Australia (DEA) is an independent, self-funded, non-governmental organisation of medical doctors in all Australian States and Territories. Our members work across all specialties in community, hospital and private practice. We work to minimise the public health impacts and address the diseases caused by damage to our natural environment.[2]

Summary comments on the Santos Narrabri Gasfield EIS

DEA notes a number of deficiencies, unsupported assumptions, known and unknown risks in relation to the project such that it recommends rejection of this proposal on the basis that it cannot sufficiently guarantee the safety of human health and ecosystems supporting health.

Concerns relating to this proposed development include the use of chemicals, impacts on water quantity, impacts to the quality of ground and surface water, impacts to soil and implications for crops and livestock as food sources, air pollution, climate risks, road safety and adequacy of monitoring and safeguards.

Introduction

For many years, DEA has been documenting the emerging scientific evidence around the potential threats to health from the unconventional gas industry. We have expressed concerns that the level of assessment, monitoring and regulation of unconventional gas exploration and mining activities is inadequate to protect the health of current and future generations of Australians and ecosystems they rely on. We have pointed out the potential for public health to be affected directly and indirectly through contamination of water, air and soil (Appendix A). A growing volume of international literature is now supporting these concerns.

Multiple state and national inquires have now documented the range of concerns. Recently the State of Victoria showed leadership with the decision to continue a moratorium of unconventional gas development. An interdepartmental submission to the inquiry that preceded the moratorium noted a range of risks to human health from this industry. It is important that the NSW government also recognises these risks and follows the precautionary principle in relation to any expansion of this industry. The document noted that "public health impacts from unconventional gas may arise from exposure to:

- Contaminated land (e.g. from chemical spills and inappropriate disposal of wastes) and secondary contamination of primary produced products (e.g. food crops and livestock)
- Contaminated surface and ground water supplies (e.g. through drinking water, irrigation, recreational use of waterways, and stock and domestic use)
- Pollutants in the air (e.g. due to fugitive gas emissions and dust from contaminated land)
- Chemicals (e.g. both those use in production and those which may be mobilised from geological sources)
- Noise from development operations".[3]

Human health impact and chemical risk assessment

The EIS fails to adequately assess human health risks from this project. For a start, it does not refer to evidence from the now considerable scientific literature on the health impacts of unconventional gas operations elsewhere.[4]

Although the EIS states "hydraulic fracturing is not proposed as part of the project" there are considerable similarities between the chemicals used for drilling and the processes in this project and other areas of unconventional gas development where human health concerns have been raised.

- According to the EIS "a chemical risk assessment report was undertaken which assessed the potential for loss of chemicals including drilling fluids and subsequent potential impacts on human health. The assessment concluded that the proposed use of chemicals including drilling fluids posed a low risk to human health due to the engineering controls and monitoring that would be in place, the limited possibility for human contact with leaks or spills, and the dilution or degradation that would typically occur in the unlikely event of a loss."
- "The drilling fluids used in the project would comprise low toxicity, generally inert substances".
- "Leaks or spills of produced water are considered unlikely".

This conclusion that risks to human health are low is unconvincing, particularly in relation to assumptions about the low likelihood of spills and accidents, and blind faith in "engineering controls". As documented below there have been numerous incidents already at the site itself, and the scientific published and grey literature, including evidence garnered by the US EPA, is full of examples where there have been incidents from spills and leaks.

A list of some of the proposed drilling fluid chemicals includes glyoxal, methanol, glutaraldehyde, tetrahydro-3,5-dimethyl-1,3,5-thiadiazine-2-thione (Dazomet), methylisothiocyanate and a range of other compounds that have potential human toxicity. The EIS itself (Table 6-7) notes the toxicity of glutaraldehyde (skin sensitiser, respiratory sensitiser, corrosive, respiratory irritant) and glyoxal (skin sensitiser, skin/eye/respiratory irritant).

Theoretical exposure scenarios generated in the EIS chemical risk assessment (Table 6-9) show a wide range of toxicity exceedances for human health and ecological thresholds. However, this finding was dismissed as unimportant merely because of theoretical modelling that suggested low likelihood of mobility to water sources.

Exposure assessment is not comprehensive – for example glyoxal can be absorbed through inhalation, not just through ingestion in water. Glyoxal is irritating to mucous membranes, acts as a skin sensitising agent, and is genotoxic.[5]

Glutaraldehyde is used in x-ray processing, embalming fluid, leather tanning, etc. It can irritate skin and mucosal membranes and cause sensitivity.[6]

Methyl isocyanate is a colourless highly flammable liquid that evaporates quickly when exposed to the air. It is used in the production of pesticides, polyurethane foam, and plastics. Exposure to low levels can cause eye and throat irritation. Higher concentrations can cause breathing difficulties and lung damage.[7]

These are hardly the "inert substances" suggested by the EIS. Also, there is no guarantee that other chemicals will not be used at the site over the next 25 years. There is no compulsion for companies to reveal to the full range of chemicals used.

We know from a range of studies that chemicals used in unconventional gas development can include toxic, allergenic, mutagenic and carcinogenic substances, as well as methane. Wastewater coming to the surface may contain volatile organic compounds, high concentrations of ions, heavy metals and radioactive substances. Long-term effects of concern include hormonal system disruption, adverse fertility and reproductive outcomes and the development of cancer. There is insufficient information on the use and mobilisation of these chemicals to make adequate health risk assessments. A major problem is the lack of public transparency around the chemicals used, the majority of which have not been assessed for safety; another is the lack of monitoring of their use.

An additional long-term concern of considerable significance because of their effects at miniscule concentrations, are the so-called "endocrine disrupting chemicals" – with potential impacts on fertility, growth and development. These levels are much lower than deemed to be safe by any Material Safety Data Sheet and these agents have been identified in regions of unconventional gas activity.[8]

Water and salt

Water consumption

This project is projected to use 37.5 gigalitres of water for its operations. The inevitable draw down of the water inherent to the process has been acknowledged and that the true extent may not be apparent for 200 years. Given the life of the project is only about 25 years, it is hard to see how existing protections, and responses such as "make good" arrangements can be sufficient. We know that with climate predictions, many areas of Australia may be affected by much more severe heat and drought into the future and water resources are critical to maintain for agriculture and other sustainable purposes.

Water contamination

The EIS states "Regardless of the type of well or bore there can be potential for inter-aquifer flow of groundwater or migration of gas if the casing construction in the bore hole is inadequate, or if the casing integrity is damaged". Even with best practice, well casing failures can allow egress of chemically contaminated fluid from the drilled wells to surrounding aquifers. The failure rate of casings is significant – estimated from recent international data at somewhere between 1 in every 50 to 1 in 16 wells drilled. Accumulation of contaminants in aquifers might have long-term impacts. Studies on the transport and fate of volatile organic compounds have found they can persist in aquifers for more than 50 years and can travel long distances, exceeding 10 km.[9,10,11]

Produced water

Produced water from this project is estimated to comprise 10 megalitres per day at peak production and 37.5 gigalitres over the life of the project. Waste water with chemical additives used in drilling returns to the surface and poses problems with treatment, disposal and storage. This produced water can contain volatile organic compounds, high concentrations of ions and radioactive substances. Substances that can be mobilised from rock formations may include arsenic, cadmium, chromium, lead, selenium, thorium, radium and uranium. CSG water brought to the surface is highly saline. Where wastewater is stored above ground in ponds and transported via networks of pipes, there is the always the potential for leaks and spills. These risks have not been adequately factored into the risk assessment, despite the documented problems that have already occurred at the site.

An Australian senate report notes about the waste water "The chemical make–up of the water varies but all of it will have significant levels of dissolved salt plus a range of other chemicals – heavy metals such as arsenic, mercury and lead, naturally occurring BTEX chemicals and uranium. The water may also contain residues of chemicals used in the drilling and hydraulic fracturing processes".

Obviously, many of these chemicals are potentially dangerous to human health, livestock and soils”.[12]

Spills, leaks and accidents

A recent report by the US EPA warned about the serious risk of spills of fluids and additives during the chemical mixing stage reaching surface water and groundwater resources They documented 151 spills in relation to the unconventional gas industry there with 13 reported to have reached a surface water body. They also documented produced water spills with median spill volumes ranging from 1,300 litres to 3,800 litres per spill. Common causes of produced water spills included human error and equipment leaks or failures. Common sources of produced water spills included hoses or lines and storage equipment. Thirteen per cent of produced water spills were reported to have reached surface water. Additionally, the US EPA warned about saline produced water migrating downward through soil and into groundwater resources, leading to longer-term groundwater contamination.[13]

An expert report prepared for the NSW Chief Scientist by Kahn[14] notes “The surface management of produced water, whether it involves treatment, storage, transport, disposal or beneficial use, creates opportunities for accidental release and environmental risks”.

This report describes between 2009 and 2011, at least 16 leaks and spills at Narrabri Bibblewindi Water Management Facility, and notes the former operator, Eastern Star Gas Ltd, did not reliably record these incidents. In June 2011, 10,000 litres of saline water leaked at the Narrabri operations project and the incident was not reported at the time despite an obligation to do so under the conditions of the petroleum exploration licence.

In October 2011, an estimated 10 kL of produced water spilled after a transfer pipeline cap burst causing water to overtop a sump. The spill travelled about 420 m to a nearby road, resulting in an area of vegetative dieback. Subsequent soil testing detected elevated sodium in the vicinity of the spill.

In July 2012, the EPA fined Eastern Star Gas over two produced water discharge events that occurred in 2010 where produced water from Bibblewindi Water Management Facility was discharged into Bohena Creek. The EPA also served Santos with a formal warning for a December 2011 discharge event that contained high levels of ammonia. In June 2012, the Resources Minister announced that NSW Government was initiating prosecution against Santos for Eastern Star ‘s failure to notify the EPA for six months about the October 2012 spill and its failure to lodge environmental management reports.

In February 2014, the NSW EPA fined Santos for a pollution incident at their Narrabri operations. The EPA found that aquifers surrounding a leaking pond showed elevated levels of total dissolved solids and other elements and that “there was no evidence that contractors.. had carried out the necessary field testing, quality control or quality assurance during the installation, as is required by current government standards."[15]

Lead, aluminium, arsenic, barium, boron, nickel and uranium were detected in an aquifer at levels elevated when compared to livestock, irrigation and health guidelines and it was reported the leak had been occurring for two years before action was taken.[16]

In January 2015, produced water was emitted from a high point vent on Santos' Dewhurst Southern Water Flow Line. The EPA investigated only after a report was made by a community member.[17]

This extensive litany of problems across two different operators appears to demonstrate company assertions of safety do not always match reality, that often monitoring of compliance and safety is inadequate, and regulators struggle to address compliance in a timely matter. Given the relatively tiny fines dispensed for non-compliance, these are no real disincentive to companies to pollute.

Despite the history from here and overseas about the likelihood of accidents and spills, the EIS inappropriately bases assumptions of risk on "considering the low initial risk of a spill occurring,"

Vulnerability to extreme weather events

The EIS states that the proposed irrigation system at peak production will have an average of 18 days per year where capacity is exceeded. Any situation such as intense rainfall events- predicted to become more frequent with climate change- may lead to spills from this system and the need to discharge much more than anticipated into the local Bohena creek, with unknown consequences on the ecology. There is no information in the EIS as to the impacts of the drilling chemicals and biocides used on the creek, particularly if there have been preceding drought conditions where contaminants may be concentrated.

Kahn[14] notes that "CSG produced water presents risks to adjacent soils, surface water and groundwater. There is potential for releases, leaks, and/or spills associated with the storage or CSG waters, which could lead to major impacts to soils, contamination of shallow drinking water aquifers and impacts to surface water bodies. Uncontrolled discharges to ephemeral streams will disrupt natural flow regimes with potentially significant ecological implications. Stored concentrates and residuals from produced water treatment pose risks to adjacent soils, surface water and groundwater. …Spills or overflows caused by flooding may lead to significant loss of containment with major impacts to local soils and surface waters. Furthermore, seepage from impoundments risks impacts to shallow groundwater aquifers and adjacent soils."

Limitations of water treatment

It has been recognised that "stored concentrates and residuals from produced water treatment pose risks to adjacent soils, surface water and groundwater" and that "treatment technologies such as reverse osmosis.. merely concentrate the salts and other contaminants, rather than eliminate them."[14]

Even when technologies such as reverse osmosis are utilised to remove contaminants from water, they cannot be guaranteed to remove all chemicals. One of the knowledge gaps highlighted by the report by Kahn[14] but not acknowledged in the EIS is the trace chemical composition of treated produced water "various small molecules (particularly low molecular weight, uncharged organic chemicals) may be poorly rejected by the reverse osmosis membrane and persist at measurable concentrations in the membrane permeate…. there is scant information available regarding which chemicals may persist, or even which chemicals to look for." It is noted that the water monitoring programs proposed in the EIS do not monitor for trace chemicals that may escape the reverse osmosis process.

Unquantified risks from massive salt waste load going to landfill.

Of huge concern is the acknowledged massive amounts of salt to be produced, stored, transported and disposed of in landfill. At peak periods, there will be 117 tonnes a day of salt taken to landfill which equates to 2.5 B-double truckloads of salt per day (or 9,348 loads of a B-double truck full of salt to landfill to be generated by the project). There is no indication of where this landfill may be, or even if such landfill is available. What measures are in place to monitor the impacts of burying all this salt? What guarantees are there that this salt will not leach into waterways and damage soils, destroying habitat? The US EPA report notes "the solids or liquids that remain after treatment are concentrated in the constituents removed during treatment, and these residuals can impact groundwater or surface water resources".[13]

Soil and food production

Contamination of land with chemicals, increased salinity, damage to soil infrastructure, changing pH, increased compaction are all real problems. There is already evidence of land contamination from CSG activity. The Australian Senate committee report noted "examples of land degradation caused by seepage from extracted water storage ponds, leaking gas pipes, untreated water seeping into watercourses and erosion caused by poorly installed pipelines".[12]

Some of the beneficial uses proposed for disposing of produced water includes irrigation of crops and stock watering. Given treated water is not tested for many trace chemicals used on or generated by the process, how can we be sure that crops irrigated or cattle watered with this wastewater will not result in human health effects via the food chain? There is no evidence of plans to test the resulting food that is produced to see if any chemicals of concern have been concentrated there.

After a scare in Queensland from BTEX chemical traces in groundwater from underground coal gasification activities near Kingaroy, a number of properties were quarantined and for a period of time and landholders with cattle exposed to this water were unable to sell their cattle.

Higher soil chloride concentrations have unintended consequences – for example they increase the release of cadmium from soil and uptake by plants, and cadmium is also produced as a contaminant from CSG wastewater. Safemeat notes "Cadmium accumulates in soil, where it can then be transferred to plants, animals and humans.... is concentrated in the kidney and liver (and, to a much lesser extent, muscle and milk) of livestock and humans. It is important to minimise cadmium intake to protect livestock health and limit the potential for human exposure through animal products".[18] The EIS section on land contamination is simplistic and fails to account for these complexities.

The section on waste says, "The salt product would be temporarily stored on site in a weather proof structure prior to load-out" but fails to mention what this structure would be and how safely it would store the material. The EIS says "Spent drilling fluid unsuitable for reuse would be transported by a licensed contractor for disposal at an appropriately licensed facility." but again fails to say exactly where this hazardous waste would end up and how we could be sure it doesn't contaminate other areas.

Air pollution

The range of air pollutants assessed in the EIS is inadequate and relies on theoretical modelling without referring to real observed data.

For example, air pollution from the existing Narrabri facility reported in the last year of data to the National Pollution Inventory shows annual emissions of 10,000 kg carbon monoxide, 23,000 kg of oxides of nitrogen, and 6,200 kg of volatile organic compounds.[19] Given the well–established health concerns in relation to volatile organic compounds from unconventional gas developments, failure to assess the level of volatile organic compound emissions in the EIS is unacceptable**.** It is important to understand levels of volatile organic compounds as well as oxides of nitrogen in order to assess ground level ozone formation. Ozone is a known respiratory irritant.

Diesel fumes are carcinogenic and are a recognised source of concern with these developments given the huge number of truck movements involved. The increase in diesel emissions related to the multiple added vehicular movements needs to be assessed.

Road safety

The EIS fails to adequately address the increase in vehicular movements expected from the project and predict the impact in terms of lost lives and disability from accidents with added traffic, especially heavy vehicles and road deterioration. Reference to the literature from other areas of unconventional gas developments would show this is a recognised risk.

Climate risks

Greenhouse gas emissions for the project were calculated by application of the Commonwealth Government National Greenhouse and Energy Reporting (Measurement) Determination 2008 and National Greenhouse Accounts Factors.

A recent Melbourne Energy Institute[20] report argues that no baseline methane-emission studies were completed prior to the commencement of the Australian CSG-LNG industry and that there is significant uncertainty about methane-emission estimates reported by oil and gas producers to the Australian government, and by the Australian government to the United Nations. Australian methane-emission reporting methodologies rely to a significant extent on assumed emissions factors rather than direct measurement and the assumptions used to estimate methane emissions include some that are outdated. In Australia, there has as yet been no comprehensive, rigorous, independently verifiable audit of gas emissions.

Methane is a powerful greenhouse gas, 86 times more powerful than carbon dioxide when its atmospheric warming impacts are considered over a 20-year time period. If natural gas is to provide maximum net climate benefit versus coal, the release of methane must be held to less than about one per cent of total gas production. In unconventional gas developments in the United States emissions ranging from 2 to 17% of production have been reported. Given the lack of direct measurement of fugitive emissions for the project, there can be no assurance that there is a net benefit to the climate from this development.

Australian researchers have demonstrated higher than expected methane emissions from Queensland gas fields and have proposed that baseline concentrations of greenhouse gases be determined, gas leakages from infrastructure measured, including compression stations and long pipelines, and an early warning system be developed in which action can be taken if specific methane concentration thresholds are reached.[21] There is no reference to this sensible approach in the EIS, so we are uninformed about how the company will be able to assess methane leakage accurately from its operations. There is also no indication of how methane leakage will be assessed after wells are decommissioned and whose responsibility it will be to monitor them indefinitely.

Appendix A

DEA submissions and official statements on unconventional gas.

National:
Submission to the Select Committee on Unconventional Gas Mining, March 2016.
https://www.dea.org.au/wp-content/uploads/Select_Committee_on_UG_Mining_Submission_03-16.pdf

Submission to the review of the national industrial chemical notification and assessment scheme, August 2012.
https://www.dea.org.au/wp-content/uploads/2017/04/NICAS-08-12.pdf

Victoria:
Submission to the Inquiry into Unconventional Gas in Victoria, July 2015.
https://www.dea.org.au/wp-content/uploads/2017/04/Unconventional-Gas-VIC-submission-07-15.pdf

South Australia:
Submission to the Inquiry into Unconventional Gas (Fracking) – South Australia, January 2015.
https://www.dea.org.au/wp-content/uploads/2017/02/Inquiry-into-Unconventional-Gas-SA-01-15.pdf

Tasmania:
Submission to the Review of Hydraulic Fracturing (Fracking) in Tasmania. December 2014.
https://www.dea.org.au/wp-content/uploads/2017/04/Review-of-Hydraulic-Fracturing-Fracking-in-Tasmania-12-14.pdf

Western Australia:
Submission to the Inquiry into the Implications for Western Australia of Hydraulic Fracturing for Unconventional Gas. September 2013. https://www.dea.org.au/wp-content/uploads/2017/04/WA-Inquiry-into-Hydraulic-Fracturing-UG-Submission-09-13.pdf

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