

Questions on Notice – Professor Melissa Haswell

Thank you very much for your questions, Senator Thorpe. The topics raised in your questions fall within my professional scope of knowledge and interpretation of evidence on unconventional gas, health and the environment which I have been engaged in for over 12 years. Through these responses, I hope to provide the answers you are seeking and convey important evidence that all members need to be aware of to complete their assessment of the relative benefits and harms associated with Middle Arm. There is much to be concerned about surrounding the procurement, pipeline transport, processing and liquification of methane gas, the loading, shipping and ultimate combustion of Liquified Natural Gas and the manufacture, shipping and discarding of other petrochemical products that may be included in Middle Arm's future.

1. The Northern Territory Government has critiqued the findings of Dr Petroni's 2022 report and peer-reviewed studies, including those by yourself and colleagues, yet endorse the studies from the Strategic Regional Environmental Baseline Assessment (SREBA). What does this say about the scientific rigour of the Northern Territory Government and their ability to assess peer-reviewed literature?

I must say that I am unaware of these critiques, but I do not understand why the Northern Territory government would not carefully heed the advice of leading public and environmental health experts with knowledge across all direct and indirect health risks associated with gas and LNG production before pledging their full support to gas developments and the Middle Arm proposal. I am aware that the NT Government instead employed a consulting firm (Jacobs) to undertake the population health component within the PH-SREBA. The authors of this report are unidentified, hence their understanding and the credibility of their capacity to inform the government on such important matters are not transparent.

In contrast, Dr Petroni provides a clear explanation of the extensive education, knowledge and experience in equivalent facilities and assessments that enabled him to provide reliable expert opinion on the risks associated with the Middle Arm proposal. Similarly, Shearman and Haswell's high educational and academic credentials in public health and medicine are identified and easily verifiable. All three health scientists used decades of collective experience to assess relevant aspects of unconventional gas operations. Their own research experience and substantial peer reviewed publications in multiple areas reflect their ability to understand and interpret the findings of our peers. The publications used to inform Dr Petroni's assessment (Petroni, 2022) and our synthesis of evidence (Haswell, Hegedus & Shearman, 2023) are drawn from highly reputable journals and sources which publish scientifically rigorous work of highly qualified researchers working in multiple leading universities across the United States and elsewhere.

I personally warned the Pepper Inquiry panel during my hour-long presentation in 2018 that the literature identifying the broad spectrum of health impacts of shale gas mining was still rapidly accumulating with increasingly sophisticated study designs across the United States. Sadly, in contrast to the Haswell et al. (2023) report, the Jacobs Report (December 2022) identified very few of the many new studies and failed to alert the government that these many new papers are progressively confirming previous findings and increasing estimates of health loss to people, environmental contamination, and greenhouse gas emissions to the atmosphere.

Besides emphasising outdated studies, the Jacobs report also shows a tendency to emphasise study limitations and plans for further studies as if these fully negate actual study findings which point to health risks. This is inconsistent with the Ethics Guidelines recently published by the International Society for Environment Epidemiology (Hetzl et al., 2024) which state that *the epidemiologist should present the nature and extent of available evidence in a clear and objective manner, and in such a way as to avoid interfering with or obstructing a precautionary approach*. In their "Toolkit for

detecting misused epidemiological methods”, Soskolne et al. (2021) identify “Demanding an usually high degree of certainty for the public health problems to be addressed; claims that more data are needed for proof of elevated risks” are frequent ways that epidemiological methods are misused to obstruct a precautionary approach and cause confusion in communities.

Furthermore, the Jacobs report presents incomplete baseline data to inform a proposed monitoring program that does not indicate understanding of the sophisticated epidemiological methodologies, long time periods and large populations required to detect any arising harms, demonstrate their association with gas operations and propose immediate protection measures in response. These also represent failure to adhere to many of ISEE’s Ethics Guidelines on quality that requires methodologies used in the published literature. These problems and others in the design of the SREBA were made known to the NT Government in the submission of Shearman and Haswell (2019) to the SREBA Framework Consultation Draft available at: https://www.researchgate.net/publication/349537526/Expert_comment_on_the_Strategic_Regional_Environ%20mental_and_Baseline_Assessment_SREBA_Framework_in_the_NT_Consultation_Draft_Authors_of_this_Review. We are not aware of any consideration of the information or recommendations made in this or the many other submissions we have made to the NT government on gas developments.

My field of environmental epidemiology requires me to abide by the following ISEE Ethics Guideline:

Along with the environment and all it sustains, environmental epidemiologists value human life and human dignity. We acknowledge that the natural environment, (including nature, ecosystems, and biodiversity) has intrinsic value, in addition to any instrumental value. Our ethical responsibility is not only to engage in objective scientific inquiry, but also to recommend to prevent negative health outcomes and to promote measures to protect the environment and public health locally, regionally, nationally, and globally”.

Environmental epidemiologists have a duty to advocate for research topics and designs that place the health of exposed or at-risk populations ahead of concern for the reputation and financial well-being of any institution or organization. They work to protect the public interest over any other interest”.

While experts are sometimes personally criticised by the gas industry for participation in advocacy and government education, the ISEE Guidelines state under the heading **Developing Moral Courage**:

Environmental epidemiologists have an ethical obligation to develop moral courage, which involves having the courage to speak up and take action in the face of ethical dilemmas or unacceptable behavior.

And finally, an interrogation of the report by some of the Northern Territory’s leading health scientists at a public presentation in Darwin yielded praise for the quality of the Haswell report and serious questions about the SREBA Health report. One expert stated that while originally skeptical of the quality of research in the past, he found that the Haswell report articulated the clear advancements in rigour of measurement and arguments on causation across the many health deficits observed among people exposed to the gas industry.

The Haswell report was also reviewed by Dr. Ruth Hetzel, Chair of the Ethics and Philosophy Committee, International Society for Environmental Epidemiology, October 14, 2023. She wrote:

“This is in response to your request for peer review of The risks of oil and gas development for human health and wellbeing: A synthesis of evidence and implications for Australia by M. Haswell, J. Hegedus and D. Shearman in the Office of the Deputy Vice Chancellor (Indigenous Strategy and Services), University of Sydney. Although I reviewed the entire document, as a pediatrician, I paid special attention to the sections on childhood diseases and exposures. Overall, I think it is a tour de

force, and I congratulate the authors on a comprehensive review of the risks to human health of oil and gas development". Ruth A. Etzel, MD, PhD

So returning back to the question posed by Senator Thorpe, while I do not understand why any government representative would not be eager or able to value reports from health experts, we would certainly welcome open dialogue and discussion with the NT Government and the Minister for Resources, the Minister for Climate and Energy and the Minister for the Environment about the health risks associated with the proposed the Middle Arm and gas developments.

2. What information does the public have about who is conducting the Health Impact Assessment for Middle Arm, and how it is being conducted? There is an accepted framework for how to conduct rigorous health assessments. As far as you're aware, has the methodology for the Human Health Impact assessment been reviewed by any independent public health experts?

Although health professionals, including the Public Health Association of Australia, have advocated for Human Health Impact Assessments (HIA) to be used for complex environmental disruptions such as climate change and unconventional gas developments, my medical and public health colleagues in Darwin do not know about an HIA being conducted for Middle Arm. We strongly support such an activity, provided it is done correctly by a highly reputable group with extensive health knowledge and experience in remote communities. The group would need to be led by an experienced and knowledgeable Aboriginal environmental health leader who **deeply understands and is able to convey to the communities involved the full nature of the large-scale water and surface impacts and risks of the gas supply chain feeding Middle Arm's LNG plant**, as well as likely social, cultural and spiritual impacts of industrialised landscaping on Aboriginal people. The team must include experts in environmental toxicology and in the links between heart health, chronic disease and stress, as well as the potential vulnerability of Aboriginal women in affected regions to harms associated with major community disruption and large FIFO and DIDO workforces moving through remote regions.

Of particular importance to the ethics of working with Aboriginal people on a gas/LNG industry HIA is to ensure there is a clear realisation of what a fully developed industry with many hundreds of wells and associated industrial infrastructure actually means to their Land and their waters, based on experience elsewhere. They must also be clearly informed that the findings and recommendations of the HIA may not be accepted by the government unless that commitment is clearly made.

Our report (Haswell et al., 2023) and the Petroni (2022) report provides a solid basis from which to identify many of the major health and wellbeing concerns that should be investigated in any HIA on gas developments and LNG. Dr Petroni used an HIA framework for his assessments. I also have substantial experience in conducting a major Health and Wellbeing Impact Assessment on climate change working with Torres Strait Islander regional and community organisations and community members. That work was funded by the Queensland Department of Environment and Science following the EnHealth Health Impact Assessment guidelines (<https://www.health.gov.au/sites/default/files/documents/2022/07/enhealth-guidance-health-impact-assessment-guidelines.pdf>).

3. The Northern Territory Government has tried to appease concerns by talking about how effective their regulation and mitigation measures are. Can you tell us about what the science tells us about how effective these measures are in reducing health impacts, particularly the increased cancer risks?

The science tells us that gas processing and petrochemical manufacture cannot be safely established in populated areas. The increasing body of research from around the world shows with increasing confidence that pollution from the gas industry increases the risk of disease in resident communities

and an absence of research that demonstrates effective measures to prevent these health risks. Each location where the gas industry has operated has claimed that they implement world class safety standards, yet we see evidence of health risks and harms across many locations where studies have been completed. One strong example of this is a systematic review and meta-analysis of 16 unique studies of blood cancers by Jephcote et al. in 2020. These studies identified blood cancers arising among a combined total of 187,585 residents of varying geographical contexts and living close to petrochemical sites between 1960 and 2011. The authors identified a 30% increased risk of blood cancer among those living within 5 kms of a petrochemical facility compared residents of unexposed communities. Importantly, they also observed that the highest leukaemia rates were recorded in the most recent studies, indicating that despite significant improvement in regulations, cancer prevention has not improved for communities located closeby.

As emphasised in the Senate Inquiry submissions and hearings, Palmerston is located extremely close to the proposed Middle Arm precinct, well within these zones of risk.

What is most lacking to date is demonstration that regulation **can and actually does** eliminate the significant direct and indirect risks to human health that have been identified throughout the large body of accumulated evidence on the oil and gas industry. One study in the US does shed light on this question, finding little evidence that best practice policies are effective in protecting nearby residents, as explained on page 55 (Haswell et al., 2023):

Weisner et al. (2023) examined a Colorado county where extensive gas production rapidly commenced following the development of a large, multi-well unconventional oil and gas site. The county adopted a variety of best practice management policies to try to mitigate negative environmental impacts on the relatively wealthy and healthy population. Despite these interventions, such as closed loop feedback systems designed to reduce emissions of volatile organic compounds, extensive air quality monitoring detected frequent significant emissions of these chemicals during pre-production operations (Weisner et al., 2023). Sound barriers were also found to be ineffective at reducing noise levels. A survey of nearly 4000 households in the area identified higher frequencies of upper respiratory, lower respiratory, gastrointestinal and acute symptoms among respondents living within 1.6 km of the extraction site compared to respondents living more than 3 km away. Frequent symptoms included nosebleeds, nausea, vomiting and shortness of breath, consistent with known responses to exposure to volatile organic compounds.

Like the meta-analysis of blood cancers associated with petrochemical plants by Jephson et al (2020), this study failed to find evidence of regulation protecting residents from symptoms consistent with exposure to chemicals known to be emitted by multiwell unconventional gas sites. Presumably the formation of secondary air pollutants from these wells, namely PM2.5 and ground level ozone, also continues, carrying risks of diseases and developmental abnormalities.

Furthermore, the tendency to discredit (as spoken by Senator Price in the Darwin proceedings) and criticise by emphasising uncertainties rather than accept the reality of and attempt to understand the risks inherent in these facilities raises further concerns about how strictly the developments would be managed in the long term if allowed to proceed. If the evidence of risks is denied, what is the likelihood that “strong regulation” will be applied and maintained.

We can also easily see the see-saw of regulatory environments in the US that grew, were dismantled and re-grown with each change of government depending on the leading party’s worldviews on fossil fuels. There is also evidence that water withdrawals increased substantially across several US basins when the price of gas dropped to reduce costs. Increased water usage and wastewater handling occurred as drilling and fracking extended further distances from one well rather than drilling new wells closer to ‘sweet spots’ of gas.

These same circumstances are clearly visible in Australian politics. The protection of human health against involuntary exposures should not be dependent on politics.

Finally, each year, the Physicians for Social Responsibility, the Science and Environmental Health Network and Concerned Health Professionals of NY publish an updated Compendium of Scientific, Medical and Media Findings Demonstrating Risks and Harms of Fracking and Associated Gas and Oil Infrastructure. The ninth edition for 2023 contains 637 pages - an additional 60 pages more than 2022 – which describe serious new incidents including spills, fires and explosions, new research findings pointing to toxic air and water pollution, massive disposal of contaminated water (more than 2 billion gallons per day), depletion and contamination of drinking water sources, ecological and biodiversity losses, and acceleration of climate risk. The document's two-page summary states:

Our examination uncovered no evidence that fracking can be practiced in a manner that does not threaten human health directly or without imperilling climate stability upon which human health depends... Across a wide range of parameters, the data continue to reveal a plethora of recurring problems that cannot be sufficiently averted through regulatory frameworks (Concerned Health Professionals of New York and Physicians for Social Responsibility, 2023; p 10).

Thus, despite the enormous experience of the United States, the Compendium provides compelling evidence that regulation in the real world does not protect people nor the environment from the risks of gas operations. LNG production and handling adds substantially more complex chemical, environmental and climate hazards on top of those of gas production and processing. The Darwin and broader Northern Territory environment, and its propensity for extreme weather events including heat waves, downpours and cyclones, likely adds even more to the potential for protections to fail, further increasing the probability for these hazards to impact even more on directly and indirectly on people's health, including unborn children (Petroni, 2022; Concerned Health Professionals of New York and Physicians for Social Responsibility, 2023).

4. Is it the case that the only way to confidently avoid the risk and protect health is to not develop the plants so close to communities, or just not at all?

The only way to avoid direct risks to human health from gas and petrochemical manufacturing plants is ensure that they are not located anywhere near where people live, work and play. The proposed Middle Arm is extremely close to a major population centre, and gas infrastructure beyond the wells, such as pipes and many compressor stations required to push the gas through the pipelines to Middle Arm safely without explosions also pose significant risk of exposure to a wide range of toxic gases (Davis et al., 2023).

However, our report, the Compendium identified above and countless documents urge recognition that the only way to confidently avoid indirect risks to clean and sufficient water supplies, food security, biodiversity and climate change is to stop building new fossil fuel developments all together. It was made clear by 500 of the world's top scientists on the Intergovernmental Panel on Climate Change (IPCC, 2023) that if governments are serious about prioritising the health and safety of people, there is no ethical way of building new fossil fuel developments in the current climate crisis.

The crisis is real and the crisis is now. In addition to the strength of evidence on direct health impacts, the rate of greenhouse gas accumulation has rapidly accelerated since the Pepper Inquiry completed in 2018. While the final Pepper Inquiry Report (Scientific Inquiry into Hydraulic Fracturing in the Northern Territory, 2018; p 208) cites that the concentration of atmospheric CO₂ just six years ago was 403.3 parts per million (ppm), in May 2024 levels were 426.7 ppm, with the highest annual increment of 4.7 ppm since recording began (<https://gml.noaa.gov/ccgg/trends/weekly.html>). Levels

of methane, a much more powerful greenhouse, also climbed from 1.85 ppm in the Pepper report to 1.93 ppm in May 2024, with record increments reported in 2020 and 2021. We are living in uncharted territory – with levels today now thought to be higher than what the Earth has experienced for **14 million years** (The Cenozoic CO₂ Proxy Integration Project (CenCO₂PIP) Consortium, 2023; Krajick, 2023).

As the panel would probably know, there are hazards and risks of failure in carbon capture and storage that we simply cannot afford to gamble on (IPCC, 2023; Concerned Health Professionals of New York and Physicians for Social Responsibility, 2023; Petroni, 2022; Haswell et al., 2023).

The Panel may also be aware of the just-released report, Too Hot to Handle: The Scorching Reality of Australia's Climate Security Failure by the Australian Security Leaders Climate Group. This is a non-partisan network of Australian Security and policy professionals who are former members of the Australian Defence Force, the defence sector and the National security communities. They state in no uncertain terms what inaction on climate change means for national security, with serious questions about the plans for Darwin's expanded military presence in a climate that will exceed the limits of liveability if we continue to expand fossil fuels. Furthermore, the report states on page 17:

“The government is strongly encouraging the expansion of the gas industry in the north, supporting projects such as Woodside's Scarborough, Santos's Barrosa, Beetaloo Basin fracking and Darwin's Middle Arm Precinct. None of these should be proceeding if the government was seriously addressing climate risk, as the corresponding emissions increase will only hasten the transition of the region to unlivable conditions. Can the gas giants still operate in the adverse conditions they are helping to create? The oil and gas industry is accustomed to operating in extreme conditions, but the world ahead is of an entirely different nature from anything the industry has experienced historically”.

Based on a both evidence and ethics, this development is in direct conflict with Australia's responsibility as a rich nation to act urgently and decisively on climate change – and to support less affluent nations to safely and effectively do the same. The Executive Director of the United Nations Programme recently stated in response to findings of the Production Gap Report 2023:

*“... this report shows the addiction to fossil fuels still has its claws deep in many nations. Governments are planning to produce, and the world is planning to consume, over double the amount of fossil fuels in 2030 than is consistent with the pathway to limiting global temperature rise to 1.5°C. **These plans throw the global energy transition into question. They throw humanity's future into question.** Governments must stop saying one thing and doing another, especially as it relates to the production and consumption of fossil fuels”.*

Prof Inger Andersen, Executive Director, UNEP [sentences bolded for emphasis]

Thus we are not exaggerating the disastrous consequences to health and wellbeing that our country would be party to should the government decide to use taxpayers money to fund Liquefied Natural Gas processing at Middle Arm. Not only are the additional greenhouse gas and hazardous air pollutants emitted during production, loading and shipping increasingly understood, the development would enable major expansion of new onshore shale and off-shore gas production to fuel the expansion of the LNG industry beyond the two facilities already processing gas and producing LNG in Darwin. Such developments would represent a serious backward step in protecting human health today and for future generations.

References

- Australian Security Leaders Climate Group (May 2024). Too hot to handle: The scorching reality of Australia's climate-security failure. Canberra, ACT. [ASLCG_TooHotTooHandle_2024R.pdf](#)
- Concerned Health Professionals of New York and Physicians for Social Responsibility, "Compendium of Scientific, Medical, and Media Findings Demonstrating Risks and Harms of Fracking and Associated Gas and Oil Infrastructure (9th Edition)," October 2023. <http://concernedhealthny.org/compendium/>
- Davis, C. D., Frazier, C., Guennouni, N., King, R., Mast, H., Plunkett, E.M., & Quirk, Z. J. (2023). Community health impacts from natural gas pipeline compressor stations. *GeoHealth*, 7, e2023GH000874. <https://doi.org/10.1029/2023GH000874>
- Etzel, R.A., Abbas, N.H., Anastario, M.P., Mustapha, A., Osuolale, O., Sarkar, A., Soyiri, I.N., Whaibeh, E., Soskolne, C.L. (2024). Ethics guidelines for environmental epidemiologists: 2023 revision. *Environmental Epidemiology* 8(2), p e299, April 2024.
- Haswell, M., Hegedus, J., & Shearman, D. (2023). The risks of oil and gas development for human health and wellbeing: A synthesis of evidence and implications for Australia. Office of the Deputy Vice Chancellor (Indigenous Strategy and Services), University of Sydney.
- IPCC. (2023). Summary for Policymakers. In: *Climate Change 2023: Synthesis Report. A Report of the Intergovernmental Panel on Climate Change. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. IPCC, Geneva, Switzerland..
- Jephcote, C., Brown, D., Verbeek, T. *et al.* (2020). A systematic review and meta-analysis of haematological malignancies in residents living near petrochemical facilities. *Environmental Health* 19, 53. <https://doi.org/10.1186/s12940-020-00582-1>
- Krajick, K. (2023). A new 66 million-year history of carbon dioxide offers little comfort for today. State of the Planet; Columbia Climate School, Columbia University, New York. <https://news.climate.columbia.edu/2023/12/07/a-new-66-million-year-history-of-carbon-dioxide-offers-little-comfort-for-today/>
- Petroni, M.D. (2022). Expert opinions related to potential environmental and human health impacts of the Middle Arm Sustainable Development Precinct as well as the Adequacy of the Draft Terms of Reference for Strategic Assessment.
- Scientific Inquiry into Hydraulic Fracturing in the Northern Territory (2018). Final Report. https://frackinginquiry.nt.gov.au/_data/assets/pdf_file/0006/494286/Complete-Final-Report_Web.pdf
- SEI, Climate Analytics, E3G, IISD, and UNEP. (2023). *The Production Gap: Phasing down or phasing up? Top fossil fuel producers plan even more extraction despite climate promises*. Stockholm Environment Institute, Climate Analytics, E3G, International Institute for Sustainable Development and United Nations Environment Programme. <https://doi.org/10.51414/sei2023.050>
- Soskolne, C.L., Kramer, S., Ramos-Bonilla, J.P., Mandrioli, D., Sass, J., Gochfeld, M., Cranor, C.F., Advani, S., Bero, L.A. (2021). Toolkit for detecting misused epidemiological methods. *Environmental Health*, 20(1), 90. Erratum in: *Environmental Health*. 2022 Nov 12;21(1):109.
- The Cenozoic CO2 Proxy Integration Project (CenCO2PIP) Consortium (2023). Toward a Cenozoic history of atmospheric CO₂. *Science*, 382, eadi5177. <https://doi.org/10.1126/science.adi5177>
- Weisner, M.L., Allshouse, W.B., Erjavac, B.W., Valdez, A.P., Vahling, J.L., McKenzie, L.M. (2023). Health Symptoms and Proximity to Active Multi-Well Unconventional Oil and Gas Development Sites in the City and County of Broomfield, Colorado. *International Journal of Environmental Research and Public Health* 20, 2634. <https://doi.org/10.3390/ijerph20032634>