Darwin – Melissa Haswell

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Speakers: Melissa Haswell

Melissa Haswell: Thank you. I'm Professor Melissa Haswell, and I'm professor of Health, Safety, and Environment in the School of Public Health and Social Work at Queensland University of Technology. And I'm also an honorary member of the Doctors for the Environment Australia. However, I'm actually doing this presentation as myself rather than representative of those organisations.

Hon. Justice Rachel Pepper: Thank you very much.

Melissa Haswell: Okay, thank you very much for the opportunity to present to you today and for the one hour. There is an awful lot that I'd actually like to say, so I may be speaking rather quickly to be able to cover the material. I have about 30 years of experience in Aboriginal and environmental health and this actual topic kind of dissects those two areas. And what I'd really like to do is to enhance, to talk a lot about that interface in terms of health and well-being. But before going any further just like to acknowledge the traditional custodians of the land we're meeting on today, acknowledging elders past and present, and really celebrating the recent discovery of the materials that indicated that Aboriginal people have been very close to here for at least 65,000 years. And I think we really do have to reflect, 65,000 years is a very long time to be not just surviving but actually thriving on this land. And that occurred through intimate knowledge, connection, and protection of environmental and social values amongst Aboriginal people.

So in the presentation I'm going to highlight some important insights that I think, just to add to the chapter on public health, but also probably to bring some of the different chapters together in terms of how they interact for health and well-being risks. And emphasising the interconnectedness of these issues across time, place, and generation. And offer some reflection on the approach that's been taken the inquiry and report. And finalise in terms of considering ethics and to what extent unconventional gas mining is actually likely to help close the gap in the Northern Territory between Aboriginal and non-indigenous people. And ask, "Can we envision ourselves as stewards for now and ancestors for the quality of life of current and future generations?"

So I'm sure as you all know, there are multiple environmental determinants of health across the different components of where we live, where we work,

where we play. And good mental and physical health actually depends on a positive living situations; where we have clean air, water safety and security, secure supply of nutritious, safe, and affordable food, a stable and a safe climate. We have meaningful livelihoods and we live within resilient and cohesive communities. And the reason why I bring this up at the very beginning is when we talk about public health we're actually talking about the science and the practise of enabling people to live healthy lives. So across the chapters in the report I often think of all of those chapters in association with health and well-being. Not just one component of it.

So I'd just like to highlight in human health risk assessment and how my presentation might add to some considerations of the report. So obviously as you all know, it's a process of estimating the potential impact of chemical, biological, physical, social hazards on a specific human population or ecological system under specific set of conditions in a certain time frame. And I particularly want to talk about the specific human population that could be effected according to decisions made regarding this industry in the Northern Territory.

So I'm sure you all know that there's a very wide gap in the life expectancy of indigenous and non-indigenous people across Australia. And if we look at the Northern Territory, there we actually see life expectancy of indigenous males at 63.4 years and of females 68.7 years. So there is a very large gap, particularly in the Northern Territory.

So a quick rundown on some of the notable studies, not captured in the interim report but actually in relation to Aboriginal people. So I'm sure you've seen this figure here where we see the remarkable increase in the number of peer reviewed publications that are looking at the environmental and public health impacts of unconventional gas mining over the years. We can see the chief scientist report was very early in the piece so it was quite easy actually to review that piece of literature. It was quite a bit harder in 2015 NWA and you guys had that little bit harder because 2016, I haven't seen an estimate but I'm sure it's well over that. I'm sure we've seen an even greater increase. And it's getting harder to actually find that literature because it's not so easy to actually cover that as you access the publications.

And I won't talk a lot about air pollution but many of those studies are actually showing just how air pollution is an under recognised but important health risk for workers and particularly people living near operations. But we know that there are operations isn't just at the fracking and the wells, it actually ... there are roads, there's a lot of transport, there's compressor stations, pipelines, there's a whole range of different activities that spread beyond the actual site of the extraction activities. And some of these air pollutants can travel far, particularly particulate matter, which increasingly we're understanding just how dangerous the smaller particulate matter of PM2.5's are to health and well-being. And also ground level ozone, which forms between a volatile organic compounds and diesel fumes, and that can actually travel far as well.

A third chemical there, which I didn't see a lot of attention in the report is around endocrine disrupting chemicals. The reason why they're so important is because they act at such low concentrations. And oftentimes they're very hard to understand their impacts because they don't necessarily follow the simple dose response curve. So there's been an argument if we're looking at water contaminants, et cetera, we should actually set the bar at endocrine disrupting chemicals because of their being so active at such small concentrations.

You've done a wonderful job ... I'm sure you all have read this, and I won't repeat what was in my report or in your report, but I think it's important to just remind ourselves that we really don't understand yet how to accurately measure exposure to air pollutants from natural gas drilling. It's not your typical constant, we have peaks and troughs, a lot of spatial, a lot of temporal variation. And we don't actually know so much around what the impacts are when you have a high, a repeated or a regular, relatively high dose interspersed with lower dose. So I think that the understanding of how these pollutants impact on health ... we're actually learning a lot now because of these studies and exposures. But then those people who are experiencing the health impacts, it's kind of too late for them.

But there are some significant new studies, which I'll make available to you, there is a new diesel fuel exposure study that's quite extensive. It actually argues that a lot of what we're seeing in these studies is actually could be related to primarily to diesel, the truck movements associated with the industry. And also a new ground level ozone study, which actually linked hospital records with ground level ozone in that time period. There's a new noise study, so we often think of noise as being unpleasant but in fact there are many potential human health impacts of noise exposure. These include cardiovascular, reproductive, even there's some evidence emerging around sperm counts for men. So this would particularly be an issue for people living nearby but also workers.

Obviously there's a lot of psycho-social and economic impacts that have been looked at and I commend you for that, your attention to Aboriginal people who are likely to be the most effected if this industry does progress. And one of the dominant features that you read, whether you're looking at the social studies around social impacts or around health impacts, is stress. The high level of stress that can be experienced as a result of being, of first anticipating these operations, anticipating this might come to your community. And then going through the various phases of the industry. And it's a 24/7. One of the things about lights and noise, and seeing trucks, et cetera, is there's a constant, constant reminder that your life is now changed. You now live in place that's highly industrialised. And these factors, there's a myriad of them obviously, they can contribute to reduced mental health, can increase the risk of depression and anxiety, and can also contribute to other physical health problems.

So I'll just quickly show you one figure from the CSIRO survey of community well-being from the Western Downs in Queensland, that was first

undertaken in 2014 and followed up in 2016. Particularly looking at the importance of community in places like the Northern Territory, and I suspect it's just as important for non-indigenous as well as indigenous people living in a rural and remote areas, is the importance of community. So this graph here is a response to being asked, "How is your community doing in terms of the changes brought by coal seam gas mining?" And if we look at the middle bar there it says, "Only just coping". Now that is a very negative ... that's not a pleasant state to be in. We can see almost a third to 40 percent, and a slight increase over time in the number of residents of the Darling Downs reporting that their community was only just coping or worse, if we go to the right. And also note that only five to six percent actually identified they felt that their community was changing into something different but better. And everybody else was just having to cope with the changes, that they didn't actually feel were making their communities better.

Also highlighting a study, relatively recent, by Morgan et al, actually using a new measure to look at coal seam gas mining stress for farmers. In addition to the background stress that farmers were already experiencing, and they found that those farmers that had licences on their properties were actually experiencing ... that that licence and the associated on farm and off farm concerns, contributed significantly to psychological morbidity. So it is real stress, and it's really having an impact on mental health amongst many people who are involved in the activity.

So just highlighting the very high distress levels amongst Aboriginal ... So thinking of bringing this industry to where Aboriginal people are living, we should look at the background of distress and think about people who are already vulnerable to the distress levels. So on the left here is females, and on the right here males. And what it's showing there is the proportion of people in the national Aboriginal and Torres Strait Islander Health Survey that reported having high or very high levels of distress in their lives already. So the grey bars are Aboriginal and Torres Strait Islander people, and the green are non-indigenous. So we can see Aboriginal people are carrying very, very high levels of distress already. And I like to point out 18-24 year old females were almost 40 percent already stressed. And that is a reproductive group, so they're a group that's actually having babies, raising babies, et cetera. So stress amongst that group is particularly concerning.

Also very high differential in terms of mental health conditions across the life spans. So the dark bars here are showing prevalence of mental health conditions. We can see from 15 right up to 45, 55, a higher proportion. So we've already got a group of people who are already vulnerable to mental health conditions, for a range of reasons. And this industry is actually known for the kinds of stresses that it brings to people in their lives. So we've got to think about that, and the context of background.

Just to highlight a couple of studies showing associations between gas developments and negative human health impacts. I know you all ... This paper was included in the report by … [inaudible] et al, showing increased cardiology in patient prevalence rates, and neurological inpatient prevalence

rates, and a number of other possible disease presentations that were higher ... presentations in areas with higher activities of drilling according to the postcode. So that's in the report, but if we actually look at hospitalisation rates of Aboriginal people already in the Northern Territory, we can see, if you go to the bottom there, in the jurisdictions comparing Aboriginal and Torres Strait Islander and non-indigenous rates, we see a 5.9 rate ratio. Almost six times higher hospitalizations among Aboriginal Northern Territorians compared to non-indigenous. And that is markedly higher than the rate ratio in the other states and territories.

So if this was to come, if this potential was actually to be realised, we would be seeing potentially much more differential amongst Aboriginal people in the Northern Territory that might be exposed to those factors associated with higher rates. You can also see there that the rate is ... and a lot of this is chronic underlying diseases, such as kidney disease, diabetes, cardiovascular disease, which are precisely those things that make people more susceptible to toxicological insults, should they occur.

And then there's a new study in Jemma I noted it in the report, it sort of said something about mixed regarding asthma. But I believe that review didn't capture this study, which is in the Journal of American Medical Association Internal Medicine. It's a very highly rigorous study and they found, looking at 35,508 patients with asthma, stratifying them by where they lived and looking at the rates at which people with asthma went and changed their medication because they needed a different dose. So in low, medium, and high areas of shale gas activity, up to the high there was about a 4.4 increase in the rate of prescription changes as a result, among people who had a high exposure to shale gas production phase.

Emergency department visits, if you look in the middle column also increase twofold. And even hospitalizations on the left hand side in the high areas, 1.6 to 1.7, 60 to 70 percent higher hospitalizations due to asthma amongst those people who are living close to activities. And this included from the drilling to the stimulation to the production phases.

And asthma is already a very serious issue for Aboriginal people. And I direct you to this study around respiratory and sleep health in indigenous Australians undertaken by a working party and this is available online. And in discussing asthma, if you look at the third dot point, the overall prevalence of asthma in indigenous people is 16 percent, higher than that in other Australians at 10 percent. The morbidity, the sickness, the debilitation from that asthma is higher, with higher hospitalizations, separation, and days for all age groups. And hospital separation rate was 2.1 times higher for indigenous people. And indigenous people are 3.2 times more likely to die from asthma. So we're talking about more serious complications already, and this industry could potentially, if that study is correct, be exacerbating an already difficult problem.

And other research as you know, found associations of living nearer to wells with self-reported symptoms; skin, upper respiratory infections. And this

one here actually takes us to another class of study. Those were prevalence cross sectional, this one is actually a highly controlled, case control study looking at migraine, fatigue symptoms, chronic rhinosinusitis, and finding increases of 50 percent higher, of 1.88 percent higher, and for migraine almost twice higher. Among people living closer to the activities. So this takes us to a new level of taking these symptoms that are reported, often by people to each other, seriously.

And just thinking about local jobs, one of the bonuses perhaps in terms of having this industry in areas ... just to remind us that this is actually an industry that carries a number of risks, particularly for workers. And this review, Eric [inaudible] … is the leader in the field in the United States, and one of the first things he says is, "We don't really understand these risks well enough". A lot more research needs to be done in the occupational space. And if you look on the right hand side we're particularly concerned ... particularly accepted that silicosis and exposure to various chemicals is a serious under studied occupational health concern. So if we think about Aboriginal people working in those areas and having possibly higher, because of their location, along with underlying chronic conditions, this may be even more detrimental.

And also the fatality rate of oil and gas workers in the US is seven times higher than the national average. This is a breakdown in 2011. From 2003 to 2013, and if you look there's different colours for the different types of causes of death. So the green arrow on the top is actually transportation. The blue, contact with objects and equipment. Three, fires and explosion. Four, falls. So looking at that high level there in terms of transportation, we can also look at Northern Territory, in which generally already has a problem with road traffic accidents and fatalities. So sorry this is hard to see, but you can see looking at states and territories and looking at the rates per hundred thousand persons in 2010, the Northern Territory had actually 21.33 per hundred thousand persons killed on Northern Territory roads. So we have to think about these additional truck movements, et cetera, in terms of an already high rate of fatalities. Which I'm sure the government's trying to do things to prevent, however it's going up now. It's not coming down. And this is just a paper showing from the United States, increasing traffic accidents associated with shale gas drilling in Pennsylvania.

So another thing ... oh sorry, I'll move on. And so if we just think about death rates already for Aboriginal people, in the Northern Territory we see the indigenous rate is 2.4 times higher than non-indigenous Northern Territorians. We know that Aboriginal people will be living and moving around in the areas more likely to be in these areas. So these death rates from fatalities we can probably assume will differentially impact Aboriginal people. And also younger people, so this shows also that ... median age, that's the age at death. That half, 50 percent, of Aboriginal people die at. It's in the 50's. So we see here males 53.4, 57.5. So we've already got a lot of people at younger ages.

And just another point about jobs being created. We really have to look, at a serious look, at what kinds of job they might be. Would they be in a already highly dangerous industry? And with the workers carrying perhaps underlying chronic conditions? What other things? Fast food outlets, alcohol outlets. So having more people coming to those areas, could very well bring unhealthy food outlets as well. I think there's been a couple of studies in the United States about that, in these areas where the workers are.

So just looking at the causes of death around, that are elevated for, or the major causes of death for Aboriginal people, we see coronary heart disease right at the top. Diabetes, lung cancer, chronic respiratory diseases, et cetera, land transport accidents. So these are thing that this industry could very well enhance the risk of.

And birth outcome studies, so I know that you looked at them in the report. And there's just a number of reasons why during gestation, in infancy and childhood, and amongst foetuses, infants and kids; there's likely to be enhanced sensitivity to the various pollutants. And to the stresses, witnessing conflicts and community division. And we have to remember in Aboriginal communities a very large proportion of the communities are very young children, infants. So this population pyramid shows on the left a much higher proportion of the population is in the young ages that would be potentially more susceptible. And there's a number of studies been done, I'll just quickly ... these have suggested that there may be lower birth weights, higher prevalence of low birth weight. And also higher complications of pregnancy among people living closer to unconventional gas activities. I'll just skip that for time.

Why should we protect Aboriginal people from an industry that may impact on birth weight and complications? Well, newborns of indigenous mothers, 15.6 percent in the Northern Territory, we already have a high level of low birth weight amongst these groups. The average birth rate is lower, that means the margin between normal birth weight and low birth weight is smaller. And low birth weight is linked to higher death rates, chronic diseases, inhibited growth and cognitive development. And 36 percent of all babies born in the NT were of indigenous mothers. Much higher proportion are born in remote areas, as compared to mostly urban based non-indigenous mothers. So pregnancies are being experienced in remote areas, and we can see this from this graph here. In remote areas, low birth weight is already particularly common among infants of Aboriginal mothers in those areas. And also infant mortality rates again in the Northern Territory, we see rate ratios on the top. Between Aboriginal and non-indigenous members of the state.

Okay, so I'll just skip that. So that's a very quick run through of why I think we need to be looking at the population when looking at risk assessment. And when we're comparing studies with quite healthy Americans who are exposed to these risks, as opposed to the health status of the people who are most likely to be exposed should the industry proceed in Northern Territory.

I would like to just make a quick comment about climate change, I'm sure there are many people talking about climate change, but I think in reading we have to admit that it remains quite controversial exactly how much methane is being admitted, and how much saving we might have between coal and unconventional gas, shale gas. And the question of why are we comparing with coal, why aren't we comparing with other alternatives such as renewable energies? To proceed without clear knowledge of this is a very big health risk. So this is what my message here is that it's a health risk. We know that there are unexpected things happening around greenhouse gas emissions that are probably surprising us around what its contribution might be. And I just wanted to direct you to this report if you haven't seen it, it really reviews all the questions around ... yeah okay. But also to remind you that we are seeing rising temperatures, there's no doubt. And if we look at the Northern Territory, we see a big spot in the middle of the Northern Territory, which is 1.5 degree temperature change already.

And I was reading around this in the sense of this higher temperatures. It's actually, even though there may be higher rainfall, the higher temperatures particularly if we have vegetation damage, could very well be actually reducing water availability in the Northern Territory into the future.

And just to remind you, this is the critical decade, if you're aware what we do now will depend on children born today or born even 10 years ago now, whether they'll be seeing a 1.5 to 2.0 degree change, or a 4.0 to 6.0 degree change. Which will be a very, very different world that they'll be trying to survive in. And the critical decade is almost over, there's only three years left to really make those transitions and head downwards. As you can see from this graph here, which is showing the sooner we start heading downwards and head towards de-carbonization, the less steep we're going to have to do. The longer we wait, the longer we plan industries into the future, we'll probably not make it. So the clock is definitely ticking, with severe impacts on human health across all the different diseases that Aboriginal and Torres Strait Islander people, and all of us may experience higher levels. It's a major health issue of our time.

So if I could just reflect briefly on the process that's being used. I want to commend you for using both, sort of a risk based approach, but also you're talking a lot about precautionary principle. You're thinking about ways in which to consult with communities. So you're doing something like a combination of these two processes in terms of using the core knowledge of environmental health. But when we think about health risk, the decision ... I guess the question that I have is how are you actually going to make the decision, especially with regards to uncertainties or how is the government going to do that? Given that we know that health risk assessment looks at things mostly individually, and mostly in relatively controlled conditions, with the concept that it can be quantified, that we can give rational scientific decisions about safety even in the face of uncertainty and assumptions. And there's a following assumption, that therefore we can protect health and well-being through regulations. So, that's kind of a trail of thinking.

But when we think about all the different risks and concerns around this industry, ranging from climate to water to economic well-being, agriculture, landscape; actually that's a very complex system that risk assessment might have a difficulty in terms of understanding their interrelationships. So I did this diagram in 2013 with my colleague, and this is where we were hearing what communities were saying. And now in 2017 we could put references around a lot of those things on that. It is very complex, and if we think about it, if even one of those goes wrong, we are in bigger trouble. Water might be fine, but if we've got a loss of economic well-being, et cetera, any one of those can be extremely harmful to health and well-being.

So what's missing? What kind of fits poorly in risk assessment? Environmental justice and power differentials don't necessarily ... they're actually health impacts of environmental injustice. Indigenous world views and ways of being and doing, the ways people move around, their relationship with the land. Intergenerational trauma, anger and racism, not fitting well when we think about the situations. Vastly different environmental health conditions, multiplicities of vulnerability. Complex interactions, mental health, and things like endocrine disruptors, industries proposing multiple de-centralized potential hazards. And perhaps outpacing human health research, it certainly has so far. And a lack of baseline.

We've got climate change changing the environment. That means ambient temperatures will be different, there'll be more chemical reactions, there'll be more deluges, there'll be more events that actually enhance both exposure and susceptibility to these potential exposures. Human error and carelessness, and politics, and volatile markets. We have to know that if we're planning for 20 years into the future, there could be very different political landscapes looking at the importance of regulation.

And I wanted to highlight how important the US is. I know some have said that it may not be relevant, but really we need to prove that. We need to have evidence that it's not relevant. And not just say, "Oh it's over there, not here". We need to actually have a supportive argument in terms of that. And perhaps very importantly, we witness what can happen to protective regulation very quickly in a Western democracy. That has taken us all by surprise, as a lot of this legislation has been challenged. We like the word "enshrined" in legislation. Enshrined makes us feel like it's protected, almost to a religious extent. But we can witness how quickly years of building that legislation can go away.

So approaches to environmental hazards could take a precautionary approach, or a risk assessment approach. And I just want to highlight a paper, because I think it's really helpful guide in terms of shale gas policies. And the role of ethics argues that policy makers have a prima facie duty to minimise false negatives. And that means not proceeding in the case of shale gas mining if there are concerns. Not to say, "Oh well that's not a good enough study, or that's probably not, it could be this or that". It's important to minimise those because number one, protection from serious harm generally takes precedent over enhancement of welfare. So someone

getting a quad bike over someone actually getting a mental health issue, that loss is more important in terms of human health than that potential gain.

Minimising false negatives is more respectful to people's autonomy, it's actually feels their health is protected. And alternative solutions exist that may provide many of the same benefits while minimising many of the harms. So I think that's a really important thing. It would be nice to actually see a comparison between this industry and some other potential industry for the Northern Territory. That might have less risks, less uncertainties, and be more favourable to the climate. And actually help us to achieve those targets and goals we need to. So unproven efficacy of regulation. We've got the word "can", we've got the word "will", we've got the word for "how long". And we've got the word "who pays?". Those are really important when we think about regulation and whether or not they're truly going to protect people and the environment.

So just to summarise, I've probably raised more questions. But that was kind of my goal, was to maybe help you put together some things that are not quite tied up in your report. And raise awareness of opening eyes to some of the fuller complexities involved in making the right decisions. I know that you are all very much dedicated to that. And health is impacted by all the dimensions you're studying. With painful consequences for those who experience the potential risks and impacts. And science can only go so far, some of these are values questions, the way we make decisions, the way we say it's acceptable or not is very much a value system. And it's also who's winning and who might be losing. And the extent to which we wish to protect, for example, Aboriginal people who have been here for 60,000 years, and also for future generations who we hope will be here for another 65,000 years.

So I personally urge the government to look for win-win solutions and development and avoid situations, which unconventional gas mining could very well be, where the most vulnerable are actually facing the greatest risks. And where the benefits ... really it's questionable where they will fall. And I'm happy to answer any questions.

Hon. Justice Rachel Pepper: Thank you. Any questions? Yes, Professor Priestly?

Professor Brian Priestly: Professor Haswell, thank you very much for your presentation. I think it's a very important one. And I hope you'll make available those slides, I had some difficulty reading what was on the slides. I think you've also highlighted the difficulty of keeping up with ever expanding literature on this area. In drafting that particular part of the report on public health, I obviously wasn't able to summarise all of the studies that were done, but to pick out some that I thought provided some light on this particular issue.

One thing I will acknowledge that I think has come out in your presentation, is that we didn't really pay a lot of attention to the differential effects on the

Aboriginal community in terms of health. Partly because we didn't have the sort of information that you've presented today. So I thank you for presenting that information, I think it'll be useful for us going forward in this. I'd also acknowledge that the approach taken was very much in line with the in health approach to environmental health risk assessment. And you've outlined some other issues that we need to think about as well. So thank you for your presentation.

Hon. Justice Rachel Pepper: Yes, Doctor Beck?

Dr Vaughan Beck AM: Professor Haswell, you noted there that it's controversial in terms of greenhouse gases, in terms of the emissions and the savings that can be perhaps achieved when comparing that emissions with coal generation. I just note that in our report we have noted that in the past there's been quite a substantial range of estimates available for greenhouse gas emissions associated with the gas industry. But over time there's been a convergence to those estimates both from top down and bottom up estimates. And so whilst there has been in the past some considerable variation, I think now, and the evidence is in the report I think, that demonstrates that convergence is now coming much closer to consensus. And that from a variety of substantial studies, which is also reported in the paper, the comparison between savings attached to emissions from coal and from ... sorry, the emissions from coal compared to emissions from gas over the life cycle is some ... report there of some studies, which is called harmonisation studies. Some 200 studies that have now converged to represent that there is savings that are attached to greenhouse gas emissions from the use of gas compared to coal.

So in summary I'm saying that I think there has been in recent times considerable work done that has led to greater convergence rather than divergence of the estimates, and so there is more certainty than ... less uncertainty.

Melissa Haswell: Yes, I think we're playing with fire though. Really I guess that's how I might answer that because, the Aliso Canyon, no one predicted the Aliso Canyon. Everyone is aware of that major accident, which took months in California to ... A well blowout was connected to a storage, and actually methane leaked out of the canyon for a couple of months before they were actually able to stop it. And it actually made a significant increase in greenhouse gas emissions for California at that time. So, and there are about 200 storage facilities, something like that, that are not well regulated, et cetera. So we can have surprises when we have oil spills, no one expects them to happen, but single events can actually make enormous differences. So I think we've got to factor that in. And super emitters, at least in that ... in Melbourne report it was talking about that we have no idea about why some super emitters are the way they are and what the situation in Australia would be. And once you've let it out it's gone, and I know there's controversies over the Condamine River bubbling, and whether that's included.

So there's a lot of ... but I guess the other thing is, cleaner but how much cleaner? And when we look at the rate that we actually need to change, is it giving us what we actually need? Or is it actually competing out, whether it's politically or ... scientists aren't doing it, but it is being used potentially to compete out energies that will actually take us into the future. And give us a chance in terms of not having situations of climate disaster.

Hon. Justice Rachel Pepper: You should just know in relation to the Condamine River, CSIRO recently, well actually not recently, some months ago now, it's only just been picked up by the Queensland papers, released a fact sheet based on their studies that shows it's a naturally occurring ... most likely a naturally occurring phenomenon. The bubbling of the Condamine River, seeping through the coal beds located very close to the river.

Melissa Haswell: I did note a paper, you might have seen something that actually took that into consideration, but the fact that we can't rule out phantom wells that weren't actually recorded, because there are many around that area. And also depressurization. So Stuart Khan, has written recently on that, suggesting that it's still up in the air as to whether that is anything.

Hon. Justice Rachel Pepper: Yes, Doctor Beck?

Dr Vaughan Beck AM: You mentioned just then about super emitters, and they do exist, there are other sources as well. In the paper that we referenced, Littlefield 2017, they've taken those into account in producing estimates from the oil and gas ... sorry, from the natural gas industry in the United States. So they have been quantified, they are included in the estimates, and they can contribute up to about 15 percent of total emissions.

Hon. Justice Rachel Pepper: Yes, Professor Hart?

Professor Barry Hart AM: Thank you for your extensive review of health and well-being issues. I had two questions. The first one related to the relevance of some of the American information that you provided. I suppose relevance from the perspective of proximity. I'm just thinking about the huge developments over there, very close wells, close to townships and so forth, compared with, if indeed that goes ahead, and then too what is likely to be there. Would you like to comment on that?

Melissa Haswell: Yes, so obviously the closer you are to the operation the more different types of ... you'll be exposed to all of the potential risks from climate change right up to what you're breathing. And certainly living further away is beneficial. However, in my view until you know what's going to happen ... I believe the last speaker spoke about where will the wells be, what sorts of protection will you have for residents in terms of how close the proximity is. I'm sure in the United States people didn't expect to have a well in their backyard when it all began. In order to ensure protection of places, when the industry actually says, "Well, that's where the sweet spot is". How are you going to deal with ensuring that there aren't people that are living within proximities. So surely it's better to be further away most definitely.

But the trucks, the changes in the communities, the visual, the noise, et cetera. Going to places that used to be quiet and now it's not, there's this constant reminder, many things will be the same.

Professor Barry Hart AM: Second one relates to that, you put up, urging the NT government to look for win-win situations. I was just thinking that particularly you identified very much the vulnerability of the indigenous population. But you didn't really give us any assessment of whether you felt that those issues could be addressed or whether they are such a magnitude that they could not be. So can you give us some examples of what you would see as a win-win?

Melissa Haswell: Certainly an industry that didn't bring in potential exacerbations of already existing health impacts. Especially for pregnant women. Every place in Australia is trying to ensure healthy pregnancies. And the sensitivities at that time really need to be taken into consideration. I mean, I wish that we would hurry up and go renewable. Because when I look at the climate change, the changes in the climate ... we are warming and we're warming very quickly. And I think methane in particular, there's a school of thought that we should be using the twenty year not the hundred year, because we are in it right now in terms of that split. Three years is not a long time to get ourselves organised to be able to come down. I think the longer we cling on to fossil fuels, the more unlikely it is that we're actually going to make it. And that's going to have massive, massive health and well-being impacts. So I don't think we should be playing with fire, I think we should actually be committing ourselves to those technologies that take us out of there, and we're not quibbling over if it's one percent or two percent.

I think Australia could do a lot better in terms of looking at these transitions and getting us all onto a plan that will really help us not just meet targets, but actually exceed them. Because other players might get out of the game, which means we've really got to ... if we want to protect future generations, we've all got to do our part. It's up to each and every one of us as individuals in our decision-making and letting people know, we are really, really close to losing the opportunity to influence the decision.

Hon. Justice Rachel Pepper: Yes, Doctor Andersen?

Dr Alan Andersen: Yes, I've just got a follow up question about the proximity issue and the relevance of the US experience to what might occur here in the NT. So you showed a lot of statistics comparing health outcomes of people close to wells and other infrastructure with those that weren't. What is typically defined in those studies as close? Or distance?

Melissa Haswell: I'd feel more comfortable if I had them right now and I could … Yeah, yeah.

Dr Alan Andersen: Yeah, just some indication… What are we talking? … Do you think?

Melissa Haswell: I know that the birth outcome ... so, the McKenzie study in Colorado was 10 miles, so that's 16 kilometres. There's not a particularly strong study methodologically, but it should be explained why was there a higher rates of

certain birth defects in that group. I think they're not even at a point to really know that point of where it's safe and where its not. I flicked through one slide that actually looked… a study around lower birth weights and they plotted actual distances from the wells and I think it was like 4 kilometres. Something like that.

Dr Alan Andersen: Yes, I was going to ask, some of these studies looked at distances and then being able to identify when an effect kicks in

Melissa Haswell: Yeah, but I think again, nobody anticipated that they would be I think 500,000 wells and 15.3 million people living within a mile of them. No one would have said that's okay. It happened and it happened for a whole range of reasons. It happened in different states with different regimes et cetera, but it happened. So, I think to stem what I… to actually hold onto your regulation when you've got a lot of pressure from industry, we shouldn't overlook the fact that the political and the pressures that will experience by the government to relax this, I've already put in this much, the more the industry is in, the more powerful they're going to feel about making circumstances favourable for them.

Hon. Justice

Rachel Pepper: Doctor Ritchie?

Dr David Ritchie: Thank you Professor Haswell. I guess the high levels of stress and associated morbidity in remote aboriginal communities is very well documented. One of the reasons for that is attributed to the general lack of purpose, lack of engagement in the economic and political life of the nation and that the idea of having industries like this give potential for employment. That's one of the reasons governments are interested in doing it. The… we have received quite a lot of anecdotal… and it seems intuitively right. Evidence that the stresses of… in a community that is very closely linked to the.. you know, having places of significance in the landscape that they're obliged to look after. The stresses created by losing control of that would be on top of the existing stresses but we haven't… are not aware of any studies or any research that's specifically dealt with. And I just wondered that you were had… firstly just commenting on the idea of whether this does offer any potential in your view for solving the first problem. But secondly, any research that you could direct us to that would help us with the second problem.

Melissa Haswell: Yes, a particular interest of mine is actually empowerment. But empowerment in a trauma informed way. So, there's two ways you can actually work with communities. You can work from their stomach, like give them a job or you can work from the heart and you can work from strengths and you can actually work with and strengthen that person to be living their values. So there's… it's an interesting… it's a very interesting area. Unfortunately we… we start and then we stop. We don't actually have the long term commitment to be able to enable developments that are actually based on empowerment to grow and sustain. I think community renewables is one and I think we're going to see a lot of studies that have actually shown that communities are proud of their renewable energy initiatives, it's

brought some jobs et cetera. So, I'm probably not answering this as well as I could.

Dr David Ritchie: Could I just put [inaudible] a bit more precisely have you ever seen or are aware of any situation where basically an extractive industry like this has brought benefits that you believe have made things better in that background level of stress or just for a community? Is there any evidence that is has anywhere?

Melissa Haswell: I can get you a systematic review because I read one recently and it is about the small community based mining around the world that actually does have positive outcomes for people. But not the great big operations that people don't have… they might try for a job or… But I went to a tour in Pennsylvania and New York with South Australians a couple of years ago with a farmer David Smith and we were… I've lost my train of thought.. Sorry, I lost my train of thought.

Dr David Ritchie: I suppose just given that governments are trying to solve the big problem and that this offers a potential, do you think that there is any evidence that this could solve the bigger… the same problem that it could be also exacerbating. So we've got to, is this going to make it worse or is it going to make it better? And we're getting a lot of… we're having evidence for both sides really. It's going to make it worse and we're also getting from industry and from government we think it's going to make it better.

Melissa Haswell: So, I was going to actually say… the thought came back… was the fact that I, we visited a well sight in Pennsylvania and all the workers were from Texas. So they're highly trained, highly skilled, they move around, they live on site 24/7 right next to the well heads. It was quite incredible. And three weeks on, three weeks off. And I think some of the occupational health risks there really do need to be looked at seriously. So, even in America where you have high levels of education, you would have local people with degrees from Pennsylvania Universities, even there, the team... it was cheaper probably to train a team and fly them all around. So it will come down... and I think that happening to some extent in terms of indigenous numbers of employment in mining is that they're fly in fly out, they're not local, they're people from the cities going out to rural, remote areas.

I see, personally, I see little chance that it's going to make a difference. There might be a construction phase, but often times I think we haven't even gotten aboriginal people properly with training and qualifications to be building houses. How are we going to get them training to a level where they can work in an industry like this safely? So there'll be extra safety precautions.

Dr David Ritchie: Thank-you.

Melissa Haswell: You're welcome.

Hon. Justice

Rachel Pepper: Yes, Dr Jones.

Dr David Jones: Ms Haswell, when we visited the CSG fields in Queensland last week, we received I guess anecdotal evidence that the flaring's seemed to be the cause of some of these symptoms. In fact we received probably more comments about that than any other thing, water quality and so on, was this flaring, whether it was a visual impact on the landscape or whether is was a chemical fall out plume that was extending from these [inaudible]. Have you've seen much, subjective evidence of a commentary of this particular issue?

Melissa Haswell: Yep, so compressor stations in particular are doing a lot of flaring because if they get too much, there's a blockage up there they're got to burn it. And compressor stations are known to be particularly hazardous from the processing as well as the flaring. As well as all the machinery, the diesel engines et cetera, so that particular situation is… and it's also in your face and multiple times, but according to what the supply is doing. But in terms of the flare itself, so the other part of your questions, it's amazing because most of the studies have been done in Nigeria where they actually are extracting oil and they don't want the gas. So, they're actually flaring massive quantities of gas which is actually putting black soot on ice and exacerbating climate change two ways. But there is not enough study about flaring and the different components, it depends on the gas quality, if you've got impurities it's not fully combusted it's [inaudible] so I think that would be something that definitely should be looked at. It's a research gap.

Dr David Jones: One of the specific [inaudible] mentioned was formaldehyde.

Panelist: Huge.

Dr David Jones: Which we found to be fairly puzzling. Do you have views on that particular one?

Melissa Haswell: Yes, so there's a [inaudible] from the Darling Downs but there's also a study from the US which showed exceedances of formaldehyde, hydrogen sulphide, so their by products of the activities.

Hon. Justice Rachel Pepper: Second last question and then last question with Dr Beck. You mentioned traffic and problems with obviously, I'm aware of the studies that indicate that the traffic incident rate ad road fatality rate is much higher than Northern Territory than elsewhere in Australia. Are there any studies that you are aware of in Queensland that have documented any increase or perhaps neutral effect or decrease or whatever it may be effect on traffic and traffic related incidences as a result of the CSG operations there?

Melissa Haswell: There is a very serious lack of studies in Queensland. So the industry is about ten years old now and there has been a very adhoc kind of report written by Queensland Health which kind of gathered together what they had. And to

date, there's been a number of PHDs looking at different social aspects et cetera but there has been no health study. The report called for the health… it said that it was not sufficient to be able to address the issue, that there should be a study of emissions and monitoring as well as the mental health impacts. And that is, I believe that CSIRO is sort of planning that now, ten years later.

Hon. Justice Rachel Pepper: Focusing just on traffic though, so the answer is no there hasn't been?

Melissa Haswell: No, not that I know of.

Hon. Justice Rachel Pepper: Thank you. Sorry, Dr Beck last question.

Dr Vaughan Beck AM: I was just following up on the discussion with venting and sorry, flaring because with operations there are three options that can take place. One is preventing, the other one is..

Melissa Haswell: Yes, you bet.

Dr Vaughan Beck AM: That's right, exactly. Then there's flaring, and the third option which is now coming into is actual capture and taking the gas into the gathering system. So, from an environmental point of view moving from venting through to capture is a much better series of progressions and the new source performance standards that are now being implemented in the United States since 2015 have moved from that venting option more into flaring and some into capture which is called green completions. And it's in the interests of both gas companies and the environment to take that progression because venting of methane to the atmosphere is not good for the environment and it's loss of dollars for the industry. So, it's potentially a win win situation as you move more up that value chain, so both the environment and the companies benefit so that's a good outcome.

Melissa Haswell: Yes, so you have to ask, why not in Queensland yet? Because I know… I thought that flaring was banned in New South Wales back around 2014. I thought that that had happened but Queensland didn't actually… it would be something actually to look at because I was aware that it wasn't necessary. Particularly in Nigeria we were talking about massive quantities, so whether it's just too expensive or they're just too busy making the oil and getting it the easy way rather than the capturing. Yeah so… If it's an ongoing expense then that would be concerning because if the price goes down, those sort of safeties… there might be pressure to reduce those safety. And I do know that when the president Trump came in one of the first things he talked about was trying to scrap the Obama controls on methane emission, it was like his second day he was talking about that. So, I wondered in there was some financial burden that that pose to the industry…

Hon. Justice Rachel Pepper: Professor Haswell, Thank you very much for your presentation today.

Melissa Haswell: Thank you.