LEGISLATIVE COUNCIL ENVIRONMENT AND PLANNING COMMITTEE

Inquiry into Decommissioning Oil and Gas Infrastructure

Melbourne – Friday 6 March 2026

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Necessary corrections to be notified to executive officer of committee

WITNESS *(via videoconference)*

Tom Cresswell, Researcher, Ecotoxicology and Radioecology, Australian Nuclear Science and Technology Organisation.

The CHAIR: Welcome back to the proceedings of the Legislative Council Environment and Planning Committee's Inquiry into Decommissioning Oil and Gas Infrastructure. We are joined by a representative from the Australian Nuclear Science and Technology Organisation, if I have got the acronym correct.

Dr Cresswell, all the evidence that we take is protected by parliamentary privilege as provided by the *Constitution Act 1975* and the provisions of the Legislative Council standing orders. Therefore the information you provide during the hearing is protected by law. You are protected against any action for what you say during the hearing, but if you go elsewhere and repeat the same things, those comments may not be protected by this privilege. Any deliberately false evidence or misleading of the committee may be considered a contempt of Parliament.

All evidence is being recorded, and you will be provided with a proof version of the transcript following the hearing. Those transcripts will ultimately be made public and posted on the committee's website.

My name is Ryan Batchelor. Welcome. I am the Chair of the committee and a Member for the Southern Metropolitan Region. I will get members to introduce themselves.

Sheena WATT: Hello. Thank you for joining us. I am Sheena Watt, Member for Northern Metropolitan Region.

Sarah MANSFIELD: Sarah Mansfield, Member for Western Victoria Region.

Rikkie-Lee TYRRELL: Rikkie-Lee Tyrrell, Member for the Northern Victoria Region.

Melina BATH: Hello. Melina Bath, Eastern Victoria Region.

Wendy LOVELL: Wendy Lovell, Northern Victoria Region.

The CHAIR: Also online we have –

David ETTERSHANK: Good morning. David Ettershank, Western Metropolitan Region.

The CHAIR: All right. Dr Cresswell, if you could state your name and the organisation you are appearing on behalf of for the Hansard record, then we will hand over to you to give us a presentation. I understand the benefit of your wisdom and expertise has a rather informative presentation, so we will give you a bit of extra time to deliver that to us today. Over to you.

Visual presentation.

Tom CRESSWELL: Thank you, Chair. My name is Dr Tom Cresswell, and I am here representing Australia's Nuclear Science and Technology Organisation, or ANSTO, which is based in southern Sydney in Lucas Heights and also at a site in Clayton.

I am going to talk to you today about in situ decommissioning of, specifically, production infrastructure, and what we do in terms of assessing potential contaminants that are within that infrastructure. My background is I am an environmental toxicologist with over 14 years experience here at ANSTO, and that is the study of how pollution impacts animals and plants in water, and specifically in this case in marine systems. I have been working in the offshore oil and gas decommissioning space for the last seven years.

As we have all heard and as I have heard this morning, the base case under legislation is complete removal of all infrastructure. However, leaving certain infrastructure in situ may be permissible under limited circumstances, and from listening to the discussion this morning, it has been made very clear as to when and where that may occur.

Looking specifically at production infrastructure, these are the pipeline networks that take the raw products from the wellhead up to a surface facility, whether that is a platform or a vessel, and then also the pipelines that might take separated products like gas or oil back onshore. Those are the main areas that we are looking at at the moment, and the question then is full removal or leave in place. As I think was alluded to in other submissions, these pipelines can act as a hard substrate for organisms to colonise on. So we can have corals, and the image there in the middle is a picture of the things that can grow on these hard structures and form quite a diverse ecosystem. So there are quantifiable benefits to the environment from leaving this infrastructure on the seabed. However, what we need to do is ensure that there are no detriments and that any risks are as low as reasonably achievable, and this comes in to where we are then looking at the potential for contaminants to impact the marine environment.

Contaminants could come from plastic coating systems on internal or external surfaces of the pipes to prevent corrosion. It could be concrete jackets; it could be zinc anodes and other things to prevent corrosion. I am going to be focused on NORM and mercury. NORM is naturally occurring radioactive material. These are items that are naturally there within the subseafloor, where the oil and gas reservoirs are, and they come out and they can form through the production infrastructure scale on the inside of these pipes, much like you see in the top right-hand side of the image there. This scale is similar to cholesterol build-up on the inside of arteries or the scale that you might find in your kettle when you are in a hard water area.

The contaminants that we are looking at, as I mentioned, are specifically NORM and mercury. What we have done in this space, working with colleagues at the Australian institute of marine studies, is last year we published a risk assessment framework for NORM and mercury to really try and lay out clear pathways for industry to come through and assess via a multiple-lines-of-evidence approach what the potential risk for NORM and mercury residual contaminants inside production infrastructure might be. This risk assessment framework uses traditional requirements of an environmental risk framework but also includes the existing requirements from a decommissioning side, as per the OPGGS Act or other Acts currently in Australia and also incorporates environmental risk assessment best practice, like the inclusion of the conceptual model, in blue there, or uncertainty assessment, in blue. We do not have currently a threshold value for either NORM or mercury – so how much is too much from an environmental perspective. This framework was designed to walk a practitioner through what sort of evidence is needed to understand where the particular risks may be and what mitigation strategies could occur.

I am going to spend the rest of my presentation talking about the specifics around NORM and mercury, the research that is there and then the research that is currently being undertaken. These naturally occurring radioactive materials, as I mentioned, can form hard mineral scales on the internal surfaces of pipes, and that is often because they are soluble. They are dissolved in the raw fluids as they are extracted from the seabed through the well, but as the temperature and pressure change, they end up falling out of solution and precipitating as this hard mineral scale. The exposure to marine organisms may be from one of two instances. That might be from a closed pipe scenario, so either during production or following leave in situ in the short to medium term, where if there is substantial build-up of NORM within that pipe, the radiation may go through the pipe and impact organisms that are colonising on the external surfaces. The second exposure scenario is an open or corroded pipe. This might be following several hundred years of leaving that infrastructure on the seabed. The pipe corrodes, and then the material inside is mixed around with the surrounding seabed. This results in a series of quite complex physical, chemical and biological processes that might lead to the uptake or bioaccumulation of NORMs into marine organisms, potential transfer through the food web and potential toxicity. I have left this up here as being complex, because the environmental system itself is complex by nature. What we are trying to do in the research space is understand each of these different facets and how they might lead to a potential impact, which then helps reduce the uncertainty within the risk assessment.

From that perspective, the work that we are doing at ANSTO along with our partners is to conduct controlled radiological exposures to Australian marine organisms. Through doing this work we have worked through the literature and have understood that while radiation impacts to humans are quite well known and well documented, even to terrestrial organisms – animals and plants that live on the land – are well documented, there is actually a sparsity of information around how radiation impacts marine organisms. So we are conducting those base level studies. We are also looking to try to understand the uptake and the accumulation of NORMs from Australian marine conditions to Australian representative organisms and understand where it may go within the food chain and then effectively use these to refine environmental quality dose rate limits, so trying to work out how much radiological dose is too much dose for the marine ecosystem.

I am going to jump to mercury and talk about the importance of the form of mercury. Mercury may exist in some gas export pipelines. I should mention as well that NORMs may also exist in gas export pipelines where there is high radium content upstream. Radium decays to radon, which may then decay to some other radioactive isotopes within the gas export pipelines. In this case from a mercury perspective mercury may form on the internal surfaces of the corroded pipe, and then when the pipe eventually corrodes and breaks through, we have a similar, quite complicated system where there are biological, chemical and physical transformations that might lead to uptake into marine organisms – the potential for biomagnification. It has been well documented that organic forms of mercury, or methylmercury, can pass through the food web quite efficiently, and then ultimately, understand what toxicity is occurring to both the ecosystem and potential human consumers of that seafood. Understanding how the form of mercury then impacts all of these processes is where our research efforts are currently being undertaken. I am going to condense down the risk equation that we look at from a contamination or toxicity perspective. From the aquatic marine organism or marine ecosystem side of things, risk is a function of bioaccumulation, so will that contaminant go from the surrounding marine environment in the water or the sediment or other organisms into the organism of interest, and then ultimately, will that cause toxicity? Without bioaccumulation, the toxicity is going to be very limited.

One of the ways that we are studying this at ANSTO is to undertake studies with our nuclear tools, whereby we take very small amounts of stable mercury oxide, a stable powder, put it into our OPAL research reactor at Lucas Heights, do some fun chemistry and then get a radioactive form of mercury out. Then under our controlled conditions within our aquaria facilities at Lucas Heights we can do some exposures via either water, diet or sediment to a range of Australian marine organisms. While the organism is still alive, we remove it, rinse it and then, because it is giving off a radioactive gamma signal, we can quantify how much radiation is within the body and therefore how much mercury is within the body. This is all conducted under animal ethics considerations and ensuring the welfare of the animals whilst we do this, but using this technique we are able to get very fine details about how contaminants might pass from the surrounding water or sediment into Australian marine organisms. In the case of mercury we are able to radiolabel different forms, so we have been able to radiolabel methylmercury, the organic form; mercury chloride, which is the main inorganic form of mercury that ends up in sea water; and metacinnabar. Metacinnabar is a mercury sulphide compound. This is the form of mercury that we are generally finding in gas pipeline samples that we have analysed across Australia. That has been corroborated by colleagues in other jurisdictions around the world – that the main form, not the only form, is this mercury sulphide.

It is important to note that mercury sulphide is well known for not being very soluble. It does not dissolve very well in natural waters, fresh water or sea water, so if something does not dissolve very well, will it be taken up through the gills or through the gut of an animal that might be ingesting mercury particles? Some of the studies that we have done have included growing algae. This was a tropical marine alga that we had grown up in the lab and then allowed a marine snail to graze on for a short period of time. Then we radio-analyse. We look at the radiation coming from the animal from a mercury perspective, and we do that over time while the animal is alive. In this case we looked then at how much mercury was retained by the body after this single feeding event and found that in snails, organic forms of mercury were very well assimilated, taken up from the diet and brought into the tissues of the animal, and then retained. The inorganic mercury chloride was taken up about 50, 60 per cent and then slowly eliminated from the body. But the metacinnabar, the main form that we are finding in gas pipelines, if present – and I should note that it is not everywhere that we find this contamination – passes straight through the animal. So there was no significant evidence of bioaccumulation of uptake. We then fed some of those snails, just after feeding on the algae, to some shrimp, looking at a simplified food chain model, and we found the same sorts of profiles with an even more pronounced passage of the mercury sulphide through the animal's gut and back out into the environment. So using these techniques we were really able to get a more nuanced understanding as to how the form of mercury and the form of the different contaminants impacts toxicity and therefore impacts risk.

I am just going to mention a few points as to where we are then going with the research. We are trying to understand if this seemingly very low bioavailable form of mercury sulphide can decompose into more soluble or more bioavailable forms, whether or not it can be organically transformed into methylmercury, which we know from the previous slide can be taken up by marine organisms very easily. We want to improve understanding of mercury transfer through Australian marine food webs to better inform food web modelling, which is another big part of the risk assessment for mercury, and then effectively pull all this together to then

understand and determine specific mercury forms or speciation water quality guidelines to feed into the ANZG water quality framework.

I am going to just leave you with three take-homes from this. I am very happy to take questions. But for in-situ decommissioning, contaminants should be assessed, and we have developed a framework in order to understand what that risk might be from a leave-in-situ perspective for NORM and mercury. Our partners are currently working to fill existing gaps within the scientific knowledge to strengthen those risk assessments. But I also want to stress the importance of then, if infrastructure is brought onshore, contaminant management still being front and centre. As one can imagine, if there are potential contaminated pipes that are brought up onshore that are then sent for smelting, we need to ensure that mercury or other radioactive materials do not go through the gas emissions. And then where are we putting that consolidated contaminant waste? Where is that going in Australia, or is it going elsewhere? I very much want to acknowledge the team. I work with a wonderful group of people here at ANSTO and within Australia. I thank you very much for your time.

The CHAIR: Thank you. That was very interesting. We had evidence at our last hearing from the South East Trawl Fishing Industry Association. Obviously there is a big south-east scalefish and shark fishery that runs from New South Wales around to the South Australian border really and goes through a large chunk of waters that are currently home to oil and gas infrastructure that is being decommissioned. Not only is that presenting challenges for the industry, but the presentation today poses questions to ask about what the risk is to the product of the trawling industry, which is the fish that we consume in fish and chips or more broadly. How significant do you think we should be taking the risk of contamination coming out of pipelines left in situ into fish that we eat?

Tom CRESSWELL: It is a great question, Chair. I would say, firstly, that contamination is not ubiquitous. It does occur. It does vary from infrastructure to infrastructure. It can vary from field to field and basin to basin, but also within a field it can vary quite substantially. I think the answer is not super clear. I would probably say to the question of 'Should we be concerned about current fisheries?' likely no, because a lot of the material is still contained, the pipelines are still intact, the infrastructure is still there. Industry are looking at good ways and have good ways of being able to clean internal surfaces of pipelines through pigging operations. Operational cessation of pigging prior to any lifting and removal is going to be quite important to reduce that potential risk.

The CHAIR: That is effectively cleaning the pipes.

Tom CRESSWELL: Correct. It is cleaning the pipes through mechanical and chemical means prior to their removal and prior to leaving in situ. Verifying how clean they are –

The CHAIR: That was my next question: how do we know how clean they are?

Tom CRESSWELL: This is certainly a challenge. There are certain techniques available of mounting detectors on pigs, these mechanical pipeline inspection gauges that go down the internal surfaces. But are they accurate enough to determine that a certain contaminant is below a threshold? I do not believe so at the moment, and that is certainly an opportunity for development. Francis Norman from CODA is aware of those sorts of opportunities, as are others. But the verification of cleaning is key.

The CHAIR: You mentioned the risk arising from corrosion. If pipelines are being left in situ, how long would you expect the pipeline to be corrosion free? Because it seems there is one set of risks while the pipes are intact, and there is another set of risks when they are corroded. What I am trying to understand is: do we know how long that period is between being intact and susceptible to corrosion, which I assume increases the risk of contamination beyond the pipe?

Tom CRESSWELL: It is a great question. Again, it is dependent on any coating materials. If you have a plastic coating, a polymer coating, on the outside of the pipe, then it might take a much longer time for that initial corrosion to occur. Without any of that external coating I think the current estimates are between two and four hundred years before corrosive breakthrough.

The CHAIR: 200 years to 400 years or two years to 400 years?

Tom CRESSWELL: Excuse me, 200 to 400 years is the current estimate. The NDRI have some good documentation on this from their previous literature reviews into that work.

The CHAIR: I might leave it there. Mr Ettershank.

David ETTERSHANK: This is fascinating and troubling. I was also interested in I think where the Chair was going in terms of the period for corrosion. When you talk about the coatings, was that the Woodside pipeline stuff that washed up on the beach? Was that the sort of plastic coating you are talking about when they were doing the decommissioning?

Tom CRESSWELL: That is a good question. I am uncertain about that specific one. I do not think that they were particular coatings that were on production infrastructure like pipelines. I think that that was something else. I am aware of that report, but I could not comment any further. As I mentioned before, certain pipelines were installed with plastic coating systems and others were not, and so it will be dependent on each piece of infrastructure.

David ETTERSHANK: We would not have knowledge necessarily unless people get down there. I think there are 2000 kilometres of pipes in the east. Would that literally require an inspection to be able to assess that?

Tom CRESSWELL: That would be a question for the industry representatives. I would imagine that there would have been records of this particular pipeline: it was this diameter, it had this thickness of carbon steel, the carbon steel was constituted of these components possibly, whether or not it then had concrete going over the top of it, which is what you would often have for a gas pipeline in order for it not to float, or a plastic coating system or just the bare carbon steel on the outside.

David ETTERSHANK: Thank you. I appreciate your work in progress and there are lots of works in progress here. Is there potentially an argument that leaving pipes and also I guess reefing infrastructure in place is a lower environmental risk than the process of removal?

Tom CRESSWELL: It is a really good question. I think it would depend on what is currently there, so what has been established from an ecosystem perspective and that habitat that is along that pipeline or that piece of infrastructure, coupled then with what is the potential risk of any contaminants on the internal surfaces 200, 400-plus years in the future, and then balanced to what happens then with the removal of that hard substrate and the ecosystem that has been there for 40, 50 years and how the waste is managed onshore. I think it is that piece of doing a holistic assessment, which unfortunately does need to then occur for each particular piece of infrastructure depending on what is in it and how deep it is, because the things that grow on it will differ from depth as well and closeness to the surface where light availability is.

David ETTERSHANK: Okay. Just one quick last question – and thank you for the answer. It is a really good one. I can see the problem there in trying to find a one-fits-all. If we are talking about the risks associated with leaking plugs, does any of the work you are doing there have application in terms of analysing that question, as opposed to having an open structure where it is plugged and it is regularly monitored? Does your work have much application specifically in that context and the risks associated with leaking plugs?

Tom CRESSWELL: By 'leaking plugs', this is a well that has been plugged and abandoned?

David ETTERSHANK: Yes.

Tom CRESSWELL: Our work will not really inform that. We are not looking at hydrocarbons. We are not looking at the main hydrocarbon materials. The focus really is on NORM and mercury downstream of those wellheads.

David ETTERSHANK: Okay. Thank you so much. Thank you, Chair.

The CHAIR: Thank you. Ms Bath.

Melina BATH: This is fascinating. So NORM and mercury exist in seawater naturally and they exist also in the subsurface oil and gas reservoirs naturally, and what we are seeing is a concentration by virtue of the extraction. Is that correct?

Tom CRESSWELL: Wonderful. Absolutely.

Melina BATH: Thank you. I want to probably go back to if this is all about risk and management of that risk. I wrote down 'Remove now and risk the environmental outcomes' and 'Leave in place safe with traps until it corrodes', and then we have environmental outcomes. What role does the regulator have, what role does the operator have and what role does your science have? How do you meld that together, if that makes sense, or what information are you missing? We are going to make recommendations. This is not our field – I will speak for myself – of expertise. What are we going to best recommend to state government in its role about the knowns and unknowns?

Tom CRESSWELL: Great question. I guess before I go to what the recommendation is in the contaminant space, you are absolutely right, there needs to be transparent dialogue between regulator, industry and science. I think we have done fairly well at being able to pursue those through the national decommissioning research initiative and other fora to be able to have that open dialogue and ask those questions of each other as to where the gaps are and then how science can come in and fill some of those gaps. Within the specifics as to what are the research needs, we have documented those within our NORM and mercury risk framework. There is a section in there specifically around what needs to be worked on. I presented a few of those in my talk as well, but it is really around I think understanding if there is contamination within a specific pipeline.

If I take a step back, it is characterising: is there contamination there in the first place, what form is it in and how is it likely to interact with the marine environment that it is currently situated in? What will then the dispersion mechanisms be in that particular environment? How do we best model that? That is certainly a gap, I think, as to how this material will end up in the surrounding sediment and the ecosystem, if contaminated, and then understanding those pieces, like I had mentioned, about transfer from the environment into marine organisms potentially then through the marine ecosystem to impact larger areas or impact fisheries. So I think clear research needs to be able to go forward. I would say that the risk assessment framework that we have developed can be applied today. There is enough knowledge and understanding out there to be able to conduct a robust assessment. If there are, though, unknowns, then that will influence the uncertainty and it then becomes the conversation between the regulator and the title holder as to: is the uncertainty acceptable, or does that uncertainty need to be reduced by conducting further studies? I hope that answers your question

Melina BATH: Yes, it does. Thank you. I say this from a neutral point of view: is there enough capacity within the government – and we have got the EPA coming up shortly and the department – and is there enough knowledge around this in government departments? That is probably something you may not be able to answer. But what are the risks in people not having enough knowledge and then doing a, 'Let's just do this'? How does industry and science build up better knowledge within the departments to be able to let them make informed decisions rather than an ideological or a blanket or an ignorant – and I mean that in the nicest form. How do they get enough knowledge to be able to implement regulations and oversights?

Tom CRESSWELL: It is a great question. As a scientist, I think that decisions need to be informed by the evidence. That is how we conduct science. Again, I think within Australia, especially from a contaminants perspective, we are leading the world in terms of having the dialogue between the science and the regulatory bodies within the government. We have regular meetings ourselves, and our colleagues at AIMS and other institutes in Australia have regular meetings with the Decommissioning Directorate, with NOPSEMA and with state stakeholders as well. There are those avenues open now for sharing of where the opportunities lie, where the data lies and where the gaps lie.

The CHAIR: All right. Thank you, Ms Bath. Ms Watt.

Sheena WATT: Dr Cresswell, thank you so much for your submission and your presentation today. I must confess, there was a lot in that and so please excuse me if my questions are a little bit explanatory in nature, because what I saw was in some parts frightening and in some parts they just raised more questions. I want to ask about the actual material that is to be decommissioned, in particular the potential toxic and harmful materials. Is what you spoke to in your presentation all that we are dealing with, or are there in fact others that you just were not able to get into today? I am just trying to understand the depth of the materials.

Tom CRESSWELL: Great question. I focused on the NORM and the mercury in my presentation. I did mention within one of those earlier slides other potential pollutants, including plastics, including coal tar, enamel coatings, concretes, so each of those should be assessed. We designed the NORM and mercury environmental risk assessment framework to be high level enough to hopefully be agnostic as to the

contaminant, such that it could be applied. While we have applied it and provided worked examples through for NORM and mercury, there is an intent that it could be applied to those other potential contaminants as well.

Sheena WATT: That is actually really helpful. Are there any gaps in the data available to responsible agencies and governments in terms of the materials and the substances that we are dealing with?

Tom CRESSWELL: That is a good question. I do not know that I would be qualified to fully answer as to whether there are gaps in those dialogues, but I think that I would –

Sheena WATT: Are there any requests that perhaps come to your agency from others that you are unable to fulfil because –

Tom CRESSWELL: I mean, certainly we are involved in characterising material that is on internal surfaces of pipelines or material that has come out of the back end of the pig train, the cleaning area or different areas on topsides. I think that there is now a good understanding as to which materials need to be considered, and then it is just about trying to do a case-by-case assessment.

Sheena WATT: Are there any differences with the materials when they hit the surface – toxicity and other considerations? We were talking in the earlier presentation about recycling and its use for the circular economy, and I am just interested to understand if there are things that we should be considering in the decommissioning process as we look to embed it then into some sort of circular economy system.

Tom CRESSWELL: That is a great question. Something that I highlighted in one of those final slides is that if production infrastructure is brought onshore it needs to be characterised well and assessment made as to if there are any hazardous materials. Again, I would say it is important to understand that we have looked at pipeline sections that have no NORM or mercury or other perceivable contaminants but, where they are present, to characterise them properly. Then there needs to be a well-thought-through decontamination process to consolidate the waste and remove it from the steel so that the steel can then be put through that recycling circular economy piece. Yes, those considerations do need to be taken into account.

Sheena WATT: As we look to that decommissioning – as you said, that is a joint responsibility between the state and Commonwealth governments – are there any regulatory systems that will need to have some further examination that you could recommend, or challenges with respect to, considering what you have just said, toxicity, or is it all good to go and we just need to get it going?

Tom CRESSWELL: Good question. I would say it is a little bit outside of the scope of my expertise, but I would mention that in conversations that I am having with industry, with regulators and with different government agencies there is that understanding that we need to be considerate of where the contaminants go and also, once we have decontaminated, where they end up in Australia.

Sheena WATT: That is actually a really good point to finish on, Dr Cresswell. My time is over, so I will return to the Chair. Thank you.

The CHAIR: Thank you. Dr Mansfield.

Sarah MANSFIELD: Thank you for your presentation today. I am interested: are there other contaminants apart from NORMs and mercury that could be of concern with the corrosion of some of these pipes?

Tom CRESSWELL: It is a good question. I think probably the foremost that need to be considered is plastics. I am not a plastics expert, but I know that there is work going into understanding the potential fate and possible impacts of plastics. There are a few others as well that we have documented within various areas that I am happy to submit if needed, like I mentioned: coating systems, coal tar enamel, zinc anodes or other material that are anodes that are protecting from corrosion within the seawater. We believe, though, for the main part, NORM and mercury represent the largest unknowns, and that is why we have focused our research on those.

Sarah MANSFIELD: Although you said the risk assessment framework could be used now to help assist with decision-making, you have identified that there are still significant gaps in research and individual pipelines. Individual pieces of infrastructure will need quite detailed assessments, because you cannot just make a uniform decision about a whole gas field, for example, and all the pipelines in it. Presumably some of that research is going to take quite a while to build up an adequate body of evidence to actually inform decisions.

What is your view about taking an approach where we apply the precautionary principle and stick with the base case and just remove the infrastructure until such time as we can establish that it is safe to leave it there?

Tom CRESSWELL: Absolutely. Environmental science 101 is the precautionary principle, and as you say, the base case in legislation is for removal. This is where the proof needs to be on making the argument that there is no risk if there is infrastructure to be left on the seabed, and therefore there need to be those investigations. You are right in saying that some of this work will take time. As I mentioned, I have been working in this space for the last seven years. I would say, though, if there is material that is a particular length of pipeline that was under consideration, I think that there are sufficient characterisation techniques now that within a few months – within six months or less than six months – there would be an understanding that no, that particular area does not represent a contaminant risk from that perspective. There would need to be other things satisfied as well on top of the contamination, but again, it does depend on understanding the infrastructure-specific piece.

Sarah MANSFIELD: Thank you. Earlier you said that it is estimated that a lot of these pipes we could expect to be free from significant corrosion or deterioration for, say, 200 to 400 years. We know that there have already been leaks and ruptures of some of these pipelines as they have aged and corroded over time; there were several a couple of years ago in the Bass Strait and I think some more reports at the end of last year. There is certainly the risk of some localised corrosion and leaks in some of this infrastructure. If a decision is made to leave it in situ, how can we be certain that it is going to stay intact and how do we monitor that corrosion?

Tom CRESSWELL: That is a good question that I would say needs to be likely directed to a corrosion expert, unfortunately, as to how comfortable we are with those assumptions. But there is certainly expertise within Australia that can inform that. Then in terms of what impact that may have there are well-established biological monitoring programs available to deploy into certain areas. Understanding the baseline contamination and pre-decommissioning assessment is important, and I know that a lot of industry folks are doing that. Then that allows you to work out if there has been an impact from any rupture. But it is a good point. As I say, I am not qualified to answer fully about the corrosion.

Sarah MANSFIELD: Just a quick one: are you aware of any of that monitoring that currently takes place post decommissioning anywhere? Say, not pre decommissioning but post – you said there are programs that could monitor that.

Tom CRESSWELL: I was mentioning, sorry, that there are broader environmental monitoring and biological monitoring programs not specific to oil and gas infrastructure decommissioning. I note that in the gulf off the coast of the US there is a big network of pipelines where my understanding is there have not been any assessments of particular contaminants, so whether there is any monitoring going on there I am uncertain.

Sarah MANSFIELD: Thank you.

The CHAIR: Ms Lovell.

Wendy LOVELL: Thank you. As I understand it – and forgive me if I am wrong – regardless of whether we remove these pipelines or not there will be deep cleaning of the pipeline but there will still be some contaminants left. Is that right?

Tom CRESSWELL: It is a good question. It does depend on the level of cleaning. To clean mercury is going to be a different chemical or physical process than you would use to clean hydrocarbons – the residual oil, for example – or different from hard mineral scales that contain NORM. The cleaning technique needs to be directed towards the potential or the characterised contamination that is there already. But yes, there have been some good advancements in understanding that there are some very good high-removal efficiencies of those techniques. As I mentioned, I think the challenge is then validating what that removal efficiency is like.

Wendy LOVELL: Therefore you would deep clean them before you removed them anyway but there is still the risk of contaminants escaping because you have got to cut it up into sections to be removed. Is that right?

Tom CRESSWELL: There is potential. I would say that it does again depend on how much contamination is there prior to cleaning and how effective that cleaning is and then understanding what the release is. I would

say that a lot of the cleaning techniques that I have read about and been aware of in discussions are very effective and therefore that risk would drop substantially.

Wendy LOVELL: If we leave it in situ, eventually everything corrodes; the sea eventually swallows everything up. You would have escape of contaminants at that point. Do the contaminants continue to multiply over time? If we clean the pipes now, leave them in situ, and they do not corrode for 200 years, is there going to be multiplication of the contaminants inside the pipes over that time?

Tom CRESSWELL: It is a good question, and if you will allow me a slightly nuanced answer, from a general contaminant perspective the answer is no, broadly, because the contaminants are there from the fluids that have been flowing through during production. Once that production ceases there is no more source of contaminants to the piece of infrastructure. That certainly would be the case for mercury. With the naturally occurring radioactive materials there is an ingrowth through radioactive decay of more radionuclides over time, so the dose to surrounding areas will increase slightly after production finishes and then will decline according to the decay of the different radioisotopes. But generally, because the source of the contamination – again, if it is there – is the production fluids or the gas flowing through, once that production ceases then no, there is no more source and no more build-up.

Wendy LOVELL: What about filling the pipes? For instance, in my electorate we have Fosterville mine. They drill tunnels probably 7 metres high and 5 metres wide. But when they have finished with those tunnels they are required to completely fill those tunnels with concrete to reinstate the integrity of the rock in the area. But if we filled the pipes with anything, would that assist to reduce the possibility of contaminants escaping?

Tom CRESSWELL: I go back to your earlier comment that the sea eventually takes everything, so it may slow down that potential interaction with the marine environment but inevitably that corrosion and eating away of even concrete or something else would occur., Assessments of what would happen, whether it is 200 years or greater in the future, I think are still valid.

Wendy LOVELL: Thank you.

The CHAIR: Thank you, Ms Lovell. Mrs Tyrrell did not have any questions, but Ms Bath had an extra one.

Melina BATH: Thank you very much. In relation to the community, so we are talking about undersea, we are talking about something that is out of sight but often not out of mind of community members who want to ensure that they are safe and their children will be safe but also the environment. I am interested in what you can provide to us. What sorts of important scientific facts does the community need to be aware of? How can that be translated so that local communities can easily understand? These are complex issues. We want people to understand and be aware but not have overt fear but not have no interest. How do you balance that? Can you, from a scientific point of view?

Tom CRESSWELL: It is a really good question and something that we discuss quite regularly within the scientific field, among academics, that we need to be bringing these issues into the public domain, as I have done today, but also we need to do it in a non-alarming way. Mercury is well known as a toxicant and can scare people – radiation similarly. This is why I have tried to provide a bit of a nuanced field. It really depends. Yes, they may be there, NORM and mercury might be there and contamination might be there. But it depends on the form, the nature, the scale and the receiving environment as to what potential impacts are. I am happy to be involved in discussions with community. But I think it is that translation of the complex themes into a way of saying, 'We are working on it. We are trying to understand and refine the risk and understand what risk that may pose, if any.' I am a marine scientist. I care deeply about the marine environment. But I am also very happy to say, 'If the data is saying that there is no risk, then there is no risk.' I think this is where we need to be informed by the evidence in this case.

Melina BATH: Thanks, Chair. Thank you very much.

The CHAIR: We have got a minute left.

Sarah MANSFIELD: I am sure I can come up with one. I am interested in the research. This is a question about the broader context of research that takes place in this space. I will preface it without any sort of judgement, but there were points raised by our witnesses in previous hearings about the independence of some

of the research that is done. A lot of it is industry funded, and I certainly appreciate that for science in Australia it is not always easy to get funding and industry provides a source of that funding. But there is obviously concern about the potential conflict of interest there. Can you give us a sense of, with the research that is available around some of these environmental impacts of decommissioning work, what proportion of it has some sort of industry link, and how much of it you would say is genuinely independent?

Tom CRESSWELL: Dr Mansfield, that is a great question and, again, something that we debate regularly. I guess I would argue that this is why we are in this space as a federal government agency, talking to the science rather than to any particular agenda. You are right in that the funding for environmental research especially can be challenging, and so yes, there is industry supporting some of the research. There is government supporting the research as well. And therefore we do need to ensure that the research that we undertake is transparent and is non-biased and is not influenced by any of those areas.

One of the ways that we are able to do that is through the peer review process at the end of a piece where we develop a scientific paper, and it goes internationally to other scholars who work in that area to look at the robustness of the science. The other way is, I think with the recent risk assessment framework that we published last year for NDRI. We established an independent advisory group at the very beginning of that process. The group was made up of two independent environmental scientists and then representatives from NOPSEMA, from DCCEEW – the sea dumping team – and from ARPANSA, the federal nuclear regulator. So they were able to provide that oversight to ensure that the science was as robust, transparent and as independent as possible. So I am really proud of that process and think that that should be brought forward to ensure that wherever there is funding provided by industry, there is also that good oversight to ensure robustness, because we need the data to make informed decisions. We need to ensure that that does remain clearly data-driven rather than agenda-driven.

Sarah MANSFIELD: Thank you.

The CHAIR: Thank you. Dr Cresswell, thanks so much for the evidence you have given us today. It has been really informative. You will be provided with a draft copy of the transcript to review in the next week, and with that, the committee will take a short break until 12 o'clock.

Witness withdrew.