

Lyn Angel: Welcome back today. Our third session for the webinar on radionuclide production. Before I reintroduce the panel, I would actually like to refer to the polling that came through from the previous session around reactors and alternate technology. The first question was cyclotrons are not a viable alternative to reactor production in Australia. 66.7% agree and 33.3% disagree. The second question was Australia should invest to lead the world in research around cyclotron production on technetium-99. 69.6% agree and 30.4% disagree.

So thank you very much for being engaged in this way with the session before. I'm going to very quickly reintroduce our panel members for those of you who've just joined us. So we have Adi Patterson, CEO of ANSTO, Associate Professor Barry Elison, Director of Nuclear Medicine, Illawarra-Shoalhaven area Health Service, Professor Dale Bailey, President of the Australian-New Zealand Society of Nuclear Medicine and Medical Physicist at Royal North Shore Hospital, Doctor Margaret Beavis, President of the Medical Association for Prevention of War, Francois Couillard, CEO of the Canadian Association and Medical Radiation Technologists joining us from Canada and I'm really pleased to see that you've been able to continue in the third session with us. Doctor Peter Karamoskos representing the Australian Conservation Foundation and Radiologist and Nuclear Medicine Physician in the Epworth Hospital in Melbourne, Professor Hosen Kiat, Nuclear Medicine Physician and Cardiologist, Cardiac Health Institute and Associate Professor Geoff Currie, CSU and Co-founder Executive of RAINS.

Welcome to this session, the final one for our series this morning. This session is going to focus on the role of nuclear medicine in the health of our community. There has been in the public domain discussions suggesting that nuclear medicine waste should not be an issue in the future because alternative technologies and techniques have or will replace it. So our expert panel is in a good position to examine both sides of the debate. We will focus on the role of the nuclear medicine rather than the waste production being the theme for today.

So the theme. There's been some discussion that nuclear medicine is not necessary with developments in CT and MRI. What is the role of nuclear medicine now and moving forward? And where does molybdenum-99 and technetium-99 sit in that market? So to start our thinking around this session, I'd like to invite Dr Peter Karamoskos who's a nuclear radiologist and representing on this panel the Australian Conservation Foundation. Thank you.

Dr Peter Karamoskos: Thank you, Lyn. In a sense, I think this question's a bit of a non-question because I don't think anybody is going to criticise nuclear medicine per se, nor say that nuclear medicine is not necessary and part of our armamentarium to treat patients. What we can say though, is question where nuclear medicine is headed. Now in the 70's, liver spleen scans were commonly done and the thought of doing a myocardial perfusion scan for heart disease was certainly being done but more of in an experimental way. Now of course, we hardly ever do liver spleen scans and

we have myocardial perfusion scanning, bone scanning and the like and multiple parts of the body with technetium as the basic workhorse. Now, interestingly however, the whole point of technetium and its use and nuclear medicine as a whole is undergoing some sort of flux because whilst the not-PET side of nuclear medicine has plateaued to perhaps marginal growth, the biggest growth from nuclear medicine and a sign of how it can reinvent itself has been PET scanning and that has really rocketed in the last 10-15 years. There are other modalities and being a radiologist, I deal with a lot of these other modalities. For example, a lot of cardiac scanning is being done using CT coronary and geography and a lot of referrers prefer to get CT coronary angiograms done rather than myocardial perfusion. Stress tests. There's also stress echo-cardiograms. There's a whole suite of offerings out there and a lot of the practice is very regional. It depends on the hospital. It depends on the referral base. In our hospital for example, stress echo-cardiograms are strongly promoted but nevertheless a lot of people aren't suitable for that. They might be overweight or they have various other constraints, so I get the cardiac stress tests. So to say the nuclear medicine doesn't have a role is not correct and I don't think, I've really met nobody in the community who thinks that. What they want from my colleagues and the community is a secure, stable supply of nuclear medicine, radio-pharmaceuticals, the practises in which case where these procedures are conducted, and to know that the people who are doing it are highly qualified. In a sense, they're agnostic about where it comes from and to the extent that there are externalities such as waste in this case, they want to know whether – how essential it is and whether there are alternatives. So in a sense we're not really debating whether nuclear medicine has a bright future. I always thought it has a bright future. It's a question of how it will then pan out.

Lyn Angel: Thank you very much, Peter. The second speaker I'd like to ask is Associate Professor Barry Elison. Thank you, Barry.

Dr Barry Elison: Thanks, Lyn. And just complimenting your moderation. It's been an absolute pleasure. Thank you.

Lyn Angel: Thank you.

Dr Barry Elison: I concur a lot with what Peter said. I think let's look at, for the sake of our listeners in nuclear medicine, is really divided into diagnostic and what we call (6:11)[therapial] theranostics. Diagnostic stuff and technetium, well that's really our workhorse. We do it all the time. It's interesting how nuclear medicine has changed. Unfortunately, I'm sitting at this table and probably been around longer than most people and have seen some major changes in nuclear medicine in the last 30 years. What is happening today is exactly what happened some years ago with cardiac where we went onto something called SPECT. Then we went onto technetium agents. Now we're coming into a change in technology with the detector technology is changing. PET has taken over a lot of the work but there's new detectors coming on in general nuclear medicine which improves the quality of the image dramatically and more importantly, they reduce the dose dramatically.

So while Peter is saying that there's been a sort of slowing down or a marginal growth in nuclear medicine, I agree with him, but we have a way of bouncing back and are bouncing back. So let's not pretend that this stuff is going away. It's not. Personally, I think that the technetium demand will grow with this technology as it becomes cheaper and used by more people, so let's not pretend it's going away. It's not. Can CT, MRI or other things replace it? In truth, probably not.

Again, as Peter said, it's very regional. It's very local. Some people prefer this. Some people prefer that. But Australia is lucky. We've got a very highly trained and highly skilled profession and I think that always helps the quality of what comes out and what the outputs are. So it's not going to be replaced. Not in our lifetime. It'll continue to fight back and prove its worth both in diagnostic and therapy.

So I'm not really going to talk too much about the therapeutic role. I'm hoping Dale will talk about that. He is one of our leaders in this country, but it is really important that we understand that we don't just diagnose, which influences management. We also provide therapy. Ten years ago, we weren't providing therapy for other cancers other than thyroid. That's changing dramatically. That's again indicating how much the specialty moves, how dynamic it really is and has been over the last thirty years. So we've got a lot to work for, a lot to work with and we need the reliable supply of isotopes whether they be therapeutic or diagnostic. Thank you.

Lyn Angel: Thank you very much, Barry. Margaret, would you like to put your views forward on this issue?

Dr Margaret Beavis: Sure. Thank you. Once again, we're starting off with a false premise. We do not believe that nuclear medicine is going away. I think nuclear medicine is an important part of patient care and I think good patient care is at the core of what everybody sitting at this table is interested in. As a GP, I really welcome improvements in patient health, be it in nuclear medicine, be it in chemotherapy, in surgery, in diabetes, in mental health. And in medicine, you're always learning because it's always changing and I think that nuclear medicine will continue to change. We should clarify for people who don't know.

PET scans don't use technetium. PET scans use a cyclotron, as is my understanding, so they don't need, produce the problems that a reactor produced isotope does. For instance, I went to a talk with a cardiologist who is a very well-respected cardiologist in Melbourne who said that he was using (9:49)[many, many few] myocardial perfusion scans because he preferred the stress echo which is just using soundwaves because it was less radiation for the patient.

Similarly as GP's, the College of GP's has put out a program which is trying to educate GP's to use less CAT scans because we are concerned about the impacts of radiation and we understand more and more that they do have impacts for the patient. So I think that there will be – this is a changing field. It will continue to change. What we're trying to say is that Australia should move with this change and also looking at other

ways of producing isotopes and entrenching old technology with building up the reactor.

So we're pushing for a sustainable and a resilient and a cleaner nuclear medicine industry. By Australia becoming a big single point of supply – 25% of the world market – again, we're entrenching the old technology that needs heavy Government subsidies and also producing ever-increasing amounts of waste. And as I've said before, this is exactly what this seminar is about because nuclear medicine has been pushed to the communities as why they need to have nuclear waste.

And in fact, about a year ago, I had a traditional owner ring me up in tears. I had no idea who she was but she rang me up in tears after seeing one of our fact sheets and said "I'm so pleased that you've written this fact sheet because I thought the only reason we needed a dump was for nuclear medicine." I said "No. That's not the truth. That in fact having a dump – having a waste facility," my apologies. "Having a waste facility will not impact on supply of nuclear medicine in Australia and that that's being used to sell the project rather than actually be realistic." We manage fine when our reactor is down. The reactor at Lucas Heights is down for 1-2 months a year, usually planned for refuelling or for maintenance, but there are times when they have unplanned outages. I believe there's an unplanned outage happening shortly and these things happen and that's the nature of reactors but if you've got a very big reactor with a big supply, then 25%, that's again showing that reactors are a problem. If you have a more diverse supply of cyclotrons or any other of the alternate technologies that are less waste producing, we would be interested in seeing where that technology goes. I think that it's important that people realise that for 20 years the Australian Government has been trying to find a waste dump and it's had resistance from every community that it's tried to place this facility. And I think that they need to recognise that producing this waste, the first principle of toxic waste is to reduce its production.

So whilst I completely support nuclear medicine, I think that there needs to be a review to again say that what are we going to produce in the future and how are we going to manage this waste. I think Adi didn't really answer the question that was put to him about consultation because I don't think there was consultation and certainly not with the community, and again, the best practice is to reduce this toxic material.

I get emails from people who are distressed by what's happening-----

Lyn Angel: Margaret, can you actually just wrap up in terms of the theme, please?

Dr Margaret Beavis: Sure. Okay. Just to say that I have had input from both (13:06)[Corn] and Hawker about the community concerns there, and I think once Kimber gets back on the picture that will also be a source of community concerns.

So basically, my premise would be that yes, we think nuclear medicine is important, yes, we think like all fields in medicine it really does keep changing and you have to keep up-to-date with it and you have to go with the flow. And I think Australia is not

going with the flow. We need to be sure that we're in with the research on cyclotrons. Thank you.

Lyn Angel: Thank you, Margaret. Profession Hosen Kiat, if you'd like to make some commentary please?

Professor Hosen Kiat: Thank you. I just like to address first these questions regarding whether one modality such as what was suggested by the public statements, myocardial perfusions scans may be replaced by echo and whether tech-----

Dr Margaret Beavis: Who said that? No one said replace –

Lyn Angel: Oh, this is –

Dr Barry Elison: This is the question that most of its (13:56)[indistinct]-----

Lyn Angel: But who said that? Okay.

Professor Hosen Kiat: This is the question that's posed by the moderator-----

Lyn Angel: Mmm, which has come from the-----

Professor Hosen Kiat: -----that technetium-based ideas can be done with PET. In the foreseeable future as a clinician and researcher, the answer to both of these questions certainly no. And what this foreseeable future, I would say ten years. And the answers would be no to both. No test is foolproof. That is a thing, a given. I'm not that particularly an important patient but one of my gastroenterologists ordered me an ultrasound of the abdomen and found something in the liver. She order CT and eventually MR, so these three imaging modalities are comparable and yet they are complimentary. They wouldn't disappear with time because it serves a purpose for her to help me in guarding her management to what's this little thing that she found in the liver.

And therefore, as a given, I would say nuclear medicine is complimentary to a lot of other imaging modalities. And then the second point that I like to make is that performance of one test versus the other which are complimentary or comparative or comparable, are basically based on three things. One is the burden of evidence on that particular test for that particular indication. That's a given, if the research evidence is heavily towards one test, of course that test may be done more often than the other. The second one is the level and ability of expertise available on their site. My own clinic is very big on the echo. They have got nuclear medicine but not very strong. Cedar-Sinai on the other hand is the reverse because their expertise and experience in nuclear medicine is so strong, nuclear cardiology predominates stress echo, okay? And the third one is largely related to remuneration-based purposes. I'm a cardiologist. I do stress echo. I am remunerated. If I order a nuclear cardiologist to Barry Elison, I don't get anything and yet both tests are comparable. And there is therefore no

question stress echo will predominate in clinical cardiology because we own it. We get remunerated. We read it, I get nothing if I were to refer to a radiology department.

And so based on this differences, these technologies will be indispensable for the community to help their doctors to guide the treatment and therefore in the foreseeable future while research continues to go on in each of these modalities, I don't see anything replacing anything. Cardio catheterization has been done since the 1960's. it's still there. It's still done every day by my interventional colleagues. They prefer to do that than myocardial perfusion study because they're experienced and they get remunerated.

Lyn Angel: Thank you very much for sharing your clinical perspective on that, Hosen. I'll now pass to Professor Bailey for your perspective.

Professor Dale Bailey: Lyn, we should be very clear in Australia that nuclear medicine is entering a golden age. We really are in a very expansionist phase. Peter's alluded to the rise in PET scanning in the last decade or so. In spite of attempts to cap it, I think, with limiting the number of indications which are rebated, it's still grown. We now have 60 PET cameras in Australia. We have over 500 gamma cameras in Australia. And the other area that's really expanded – and Barry has alluded to this – is in therapies. If you look at the world, Europe and Australia are moving forward very, very rapidly in these areas.

The Germans in particular through the German Cancer Research Foundation have produced some wonderfully elegant molecules that target molecularly at receptors expressed in cancers. And Australia may not have invented it, but we've really capitalised on it, such to the point now where we have the largest usage of prostate cancer scanning using these techniques in Australia. Invented in Germany, but we translated it rapidly and deployed it. We are agile. We are innovative. We're nimble. We can adapt to this. We have a good community. We share ideas and we're supported by good local production that allows us to do these activities. Nuclear medicine advances by developments in biology, the genome, understanding the receptors expressed in certain cancers. It advances by physics. Instrumentation getting better all the time. But most recently it's advanced predominantly by the chemistry.

The synthetic chemistry that can develop a molecule that will target a very specific receptor that allows us to develop that magic bullet that treats systemic disease. We don't treat one lesion in a patient. We treat all lesions in the patient. We treat microscopic lesions that aren't even visible.

So we really are in a very ideal phase at the moment. ANSTO appear to be moving in step with us, expanding their range of options by bringing on new production facilities that helps us. Where does technetium fit into this? Well it's interesting. We have ANSTO and we've got access to some of the best radionuclides for these imaging techniques to go with PET, to go with SPECT. Other countries don't have

that. And even where they do have it. Even in Germany where they've invented a lot of this technology, what've they done? They've invented a technetium-based PSMA prostate cancer agent now because the demand – as we were talking about in the break, Margaret – is so great that the 60 PET cameras in Australia probably couldn't deal with the burden.

So now having gone through a development phase - and this often happens - PET is at the research end where chemistry can be a little bit simpler, we can develop a technique, demonstrate the use of it and then say "Okay, how do we scale up for major impact and in the health of the country?" Technetium comes in. In New Zealand, they have very limited cyclotron access, very limited PET access, no Government support as such for it, and they use technetium to look at many of the rare cancers that we routinely look at with the Gallium 68, the PET agents here.

So I think the viewers and the Australian community should be aware that we really are at the very forefront of these developments. We are in a fantastic position in Australia at the moment. I know the Canadians are very envious of what we can offer our patients with neuroendocrine tumours in terms of diagnostic imaging and therapies. There's, I think, two or three centres only in Canada that offer this. We have two centres in Sydney and major centres in every capital city in Australia where we can actually meet the demand now.

So we are really in a golden age, as I call it, for nuclear medicine and so rather than questioning is there a role and things - and we're all in agreement as Peter says – we're actually looking at what else we can do. And I just think these developments are going to accelerate and continue and I do feel there's a bit of a tsunami heading our way in terms of prostate cancer diagnosis and management. Thank you.

Lyn Angel: And sadly, you may well be right. And again, from the patient's perspective I certainly, I'm sure there wouldn't be many potential patients or consumers out in the community that would be sitting back and wanting to see any of these developments slow down provided there is that discussion around the facts and the science and therefore, the risks and the benefits being carefully looked at by the experts so I think this is really helpful.

I'm now going to ask Geoff Currie if you've got some thoughts to, from a RAINS perspective, thank you.

Geoff Currie: Yes, from a RAINS perspective and Dale sort of hit the nail on the head is that, you know, that HETS [22:27] is not as accessible in rural Australia and technician [23:30] remains at the forefront of diagnosis for rural communities and will in the future and I think probably in the metropolitan areas as well that it will, you know as we move from Gallium 68 bringing a technician back in for some of those traces because its more accessible and you've got the access to such a large number of gamma cameras in terms of simplicity so from a rural perspective it's crucial that you know we don't create a two-tiered healthcare system where we create a model where

rural Australians have a slightly different access to the healthcare system than our metropolitan counterparts and we've had that just not so long ago, we were in that situation where our rural Australians, whether it's a prostate cancer patient who would actually have to go to Sydney for both you know diagnosis in nuclear medicine as well as therapy, now we've actually got those big rural centres emerging with not only The Nuclear Medicine Department but the Cancer Centres as well and Orange and Wagga and Lismore are examples of those and it creates that next level I guess discrepancy where we now have patients that come for PET and we're seeing PET emerge into those rural communities and some of the cutting edge therapies we still come to Sydney for but you know, that whole role of nuclear medicine's crucial for the health and wellbeing of our rural patients and we can't do that without access to generators and it's the generator production that will be the ongoing I guess lifeline.

Lyn Angel: Thanks for that Geoff. Before I actually get back to those panel members who've had an opportunity to speak, I would like to ask Francois, since we're taking you away from dinner time for a bit longer, do you have any comments or questions that you would like to just contribute to this part of the discussion?

Francois Couillard: No, I'm happy to let the physicians talk about the clinical aspects of the use of nuclear medicine. It's still a vibrant and viable modality in Canada and so but ----

Lyn Angel: Thank you, thank you Francois.

Francois Couillard: Yeah.

Lyn Angel: And Adi, have you got anything to add to this?

Adi Patterson: I think because ANSTO research right across into the clinical applications works with the community very intensively, it's certainly my hope and my dream that we'll expand our ability to look at the new modalities, to look at all modalities, but I think people forget that MRIs are a nuclear technique, it's the nucleus that gives us that beautiful picture, it's just less contested than some of the others but I think when we're talking nuclear medicine I'd always include MRI and the associated modalities as a nuclear technique.

So nuclear I think can contribute to this debate. We're seeing many new things happen and I think it's the intersection of the pragmatic and patient-orientated approach we see in our hospital system, including our rural hospitals, and rural, regional Australia should not be excluded from the debate of access so the job of ANSTO is not to pick winners, we are interested in accelerators, we are the leading accelerator organisation in Australian, we're very keen to stay in touch with the developments that are happening there.

The most important thing for me is that if we're going to pick our technologies, we might not be able to pick the right outcomes for health. I think we should be having a technology-neutral view of this, there's not an either or, there's a both and type of

philosophy here and I think we should do it in a way that when the energy like it was in Germany from the technetium 177, they did the hard yards, the rest of the world is benefitting. Where will we pick to work? We'll work closely with the clinicians, with the research community, with the people who are thought leaders in our hospitals and in our university education system so ANSTO will not pick winners but we will respond to and serve the communities and we do have an international view, we are part of a group of research reactors to try to change the conversation to a mutual support and assurance of supply.

Lyn Angel: Thank you Adi. Now Margaret, you've got your hand up.

Dr Margaret Beavis: I just think it's really important to be clear that again, we're getting set up a false argument. Regional nuclear medicine should be just as good, whether we have a reactor in Australia or not, once again, for one to two months a year Australia imports its isotopes like most countries in the world do.

Dr Adi Patterson: Can I just clarify, we don't anymore. We haven't imported them for a few years.

Dr Margaret Beavis: Well that's a really good point too to clarify.

Dr Adi Patterson: And we don't close for two months at a time, we close for a few days and we can cover the radiation spectrum. The whole point of having a 300 day operating reactor is that we no longer close for a couple of months. I think that was the h (27:04)

Dr Margaret Beavis: That's interesting.

Adi Patterson: Yeah.

Lyn Angel: Thank you Adi.

Dr Margaret Beavis: Nonetheless the fact still remains that most countries around the world do import their nuclear isotopes and that regional medicine will not be changed, whether Australia in the long run - and I'm not talking now - in the long run whether Australia continues to have reactor or not should not impact on whether regional medicine, regional centres, get good quality healthcare and in fact I would be appalled if the regional centres were – if that was the case.

I think it's also too, just for clarity, that MRIs are not nuclear medicine, that there's no radiation for the patient when you have an MRI, so if your GP orders an MRI in preference to a CAT Scan it is a lower radiation thing so it's safer for the patient.

Professor Dale Bailey: It isn't. It's not safer.

Dr Peter Karamoskos: Its actually, it's not safer.

Professor Barry Elison: Well it's a contrast.

Dr Margaret Beavis: It doesn't, it doesn't -----

Professor Dale Bailey: If you have contrast it's not safe.

Dr Margaret Beavis: If you have contrast, if you have contrast most of the -----

[SPEAKING OVER EACH OTHER]

Professor Dale Bailey: But everybody has contrast.

Dr Margaret Beavis: Not, absolutely not.

Professor Barry Ellison: Well best practice its DNA damage as well. (27:54)

Dr Margaret Beavis: Absolutely not.

Professor Barry Ellison: Its DNA damage as well. (27:57)

Dr Peter Kamoskos: Oh come on Barry.

Professor Barry Ellison: Oh yes there is.

Dr Margaret Beavis: Absolutely not.

Professor Dale Bailey: More people have a reaction -----

Dr Peter Kamoskos : Come on.

Professor Barry Elison: (28:03)

Professor Dale Bailey: -----to an MR scan than they have to a nuclear medicine.

Lyn Angel: Can we just -----

Dr Margaret Beavis: I'm sorry, I do a lot of MRs for various processes -----

Lyn Angel: Margaret you made that statement but can I just ask (28:10) for a -----

Dr Margaret Beavis: It's not correct to say that there's more reactions.

Lyn Angel: ----- response please?

Dr Margaret Beavis: Yes.

Professor Dale Bailey: Peter, what's the rate of reaction to contrast?

Margaret Beavis: It's not, its contrast.

Professor Dale Bailey: Not contrast, contrast.

Dr Peter Kamoskos: The question was whether it was a nuclear study, it's a bit misleading.

Professor Dale Bailey: I won't buy into that.

Dr Margaret Beavis: No, you're talking about contrast not MRIs.

Dr Peter Karamoskos: Radiation radioactivity.

Dr Adi Patterson: But it is a nuclear technique.

Dr Peter Karamoskos: In the sense that all atoms have nuclei everything is a nuclear technique.

Professor Dale Bailey: That's where the signal comes from.

Dr Peter Karamoskos: But its ionising radiation and the inherent waste in radioactivity that is the issue here.

Geoff Currie: (28:43) radiation.

Dr Margaret Beavis: If you had a choice for your daughter a CAT Scan or an MRI which one would you choose? You'd choose MRI.

Professor Dale Bailey: It depends on the indication.

Professor Barry Elison: It depends on the indication.

Dr Margaret Beavis: Indeed, indeed. Indeed, but -----

Lyn Angel: As the moderator can I just - excuse me, can I just comment? If that question was put to me, I would be hoping that my specialist -----

Professor Barry Elison: Would be adequately informed.

Lyn Angel: ----- would actually respond well what is the best for me for my situation? And then to look at, weigh up the risks.

Dr Margaret Beavis: Indeed, absolutely.

Lyn Angel: I think that's really critical and I think for communities listening and viewers listening to this session, it is important to just stick to the facts around this and the science around this and also hopefully to build up more and more confidence for those people who are actually engaging with patients in the community that they are really well-informed about the facts with it.

Dr Margaret Beavis: Absolutely, and I think we -----

Lyn Angel: If you want to make the closing statement just around that particular issue.

Dr Peter Karamoskos: Can I just pass that for a few minutes and let me just get my thoughts together?

Lyn Angel: Absolutely.

Dr Peter Karamoskos: Anybody else.

Lyn Angel: So anybody else like to participate in the conversation at this point? We haven't had any questions coming from our views. Any other comments? Adi?

Dr Adi Patterson: Could I just say in the nuclear medicine area we're very, very fortunate to have a strong nuclear medicine community and that's leadership right up to the top end where the current President of the World Federation is Professor Andrew Scott, he's from Melbourne, there'll be a big conference here and it's the strength of this community that our clinicians looking at all the modalities that are available, have create a global footprint from the small footprint in Australia, where we are respected and integrated community. That is to do with the clinical interface, but it is also to do with the support and integration of our services over time and I'm agnostic as to whether those come from reactor-based techniques or cyclotron-based techniques or nuclear magnetic resonance, but I think the thing that we need to do as a community is recognise that our world standing is based on the underpinning support and the clinical excellence and so for me it's a privilege to be part of that supply chain but we're not a sole supplier, and so what we should be talking about is how do we get a global community that can get new modalities to people more efficiently? The way that we'll bring new modalities in this is to be a respected player.

Lyn Angel: Yes.

Dr Adi Patterson: The way that we'll stay a respected player is to have the most control over the supply chain that we possibly can, whether its cyclotron or reactor-based.

Professor Dale Bailey: Just to add to what Adi's saying - we would normally think that the USA would lead the world in most things because of its size and market and things like that but certainly nuclear medicine, they envy Australia, and the point was made they import their isotopes, so they've really had a very low investment for a long time in nuclear medicine and those chickens are coming home to roost now, 20 years down the track.

Nuclear medicine is in poor shape in the US. They don't have any access to the Gallium 68 or they haven't previously, they've just started, ten years behind us. They're not treating patients with lutecium therapies for many, many reasons we are really at the front and you would think the US should be able to get it right, the money they spend on their health system, 13% of GDP, yeah, and they envy us what we can do and how we can respond to new molecules, new radionuclides, new technologies as they're introduced.

Lyn Angel: Thank you.

Professor Dale Bailey: They're good in some areas.

Lyn Angel: I do actually have a question from the viewers if you don't mind. Cameron asked from the audience, non-ionising radiation in MRI but there is non-ionising radiation and there are plenty of people out there who claim it's not safe so as this is all around fact finding and trying to clarify for the community, is there just a brief comment from anyone who'd like to respond to that?

Professor Dale Bailey: So the non-ionising radiation used in the MRI scanner is in the form of radiofrequency waves so FM-type frequencies that we have floating around and I think everybody would accept that that's a fairly safe thing. It doesn't cause direct damage to the DNA as ionising radiation does, so the same sorts of issues come up about transmission lines, mobile phones causing brain tumours and things like this, most of the research or all the research that I'm aware of that's creditable in this area, has not shown a link between any damage and that non-ionising type of radiation, microwave, radio waves.

Lyn Angel: Thank you.

Dr Peter Karamoskos: On that point -----

Lyn Angel: Yep.

Dr Peter Karamoskos: It raises a good question. The evidence is tenuous and a lot of it is more for protective purposes. There are standards for non-ionising radiation. I think it's important for patients out there to realise that if there's a proper medical indication for a test, whatever it is, then by and large the benefits outweigh the risks so it's always a risk-benefit trade-off but it's got to be medically indicated and that's a discussion that the patient has with their doctor. As Margie says, she has these discussions all the time.

As far as the US market, and I think that's an important point that Dale raised, they might envy us, however, for 50 years the US market relied entirely on importation of its radio pharmaceuticals that they accounted for 50% of the technician market worldwide so it certainly didn't stop the proliferation of nuclear medicine in that country, in fact they were the highest user of nuclear medicine of any country in the world. Where they were let down was the reactors were aging and the inherent vulnerability in the supply chain model that reactors pose, a linear supply chain with a single point failure, now this has been the case for the first decade and a half this century, we're trying to get our act together as Adi said, it needs cooperation around the world, it needs people, rather than competing for market share, cooperating for market share, cooperating in that market space, whether it's going to succeed in the long run who knows? When you invest a lot of money and you've got a huge sum cost, there's always the incentive to chase market share so let's not kid around that having a reactor gives us security of supply, the United States has security of supply for about 50 years before it all went pear-shaped and reactors inherently the business model, can, is prone to that shutdown, I mean the Opal reactor was shut down for almost two years.

Now and as Adi said, we were lucky to have South Africa on standby, however that's not always the case around the world.

Cyclotrons have never been a problem for supply because they've never been around so all these problems that we're talking about and all these failures, these market failures, have all been cyclotron-driven, have all been reactor-driven, not cyclotron-driven. I think it's important for people out there to know that no modality, no generation modality is failsafe and the reactor one is particularly prone to failure, as the Canadian said, and why they rejected another reactor and instead chose to explore cyclotron technology. Australia has the beauty about having a reactor that's not about to shutdown so we have lead times so we can explore these alternative modalities to determine what is the most safest and most diversified supply of isotopes for the future.

Professor Dale Bailey: And Peter, we often need a short sharp shock to jolt us into reality and we had that in 2009 and 10 where the most effected nation in the world was the US because they didn't have the supply of technician and patients there were denied tests that they should have had.

Dr Margaret Beavis: They learned from that.

Professor Dale Bailey: And we can extrapolate whatever we want emotionally from that but you know, since that time the inadequacies of the system have clearly been demonstrated and as Adi has been telling us, you know there's now a cooperation internationally to ensure that doesn't happen, so I think that's a good thing that its working together like that.

Dr Peter Karamoskos: It is a good thing but remember the business model, the linear supply chain, hasn't gone away, it's still a linear supply chain, you've got reactors ----
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Professor Dale Bailey: Well it's a multi-node supply chain now.

Dr Peter Karamoskos: Well it's trying to become a network.

Professor Dale Bailey: Yeah.

Dr Peter Karamoskos: It's trying to but let's see, it hasn't been done before.

Lyn Angel: It's a bit exciting. I'd like to ask Barry for some comments please.

Professor Barry Elison: I think we need to be a bit careful. In 2000, Adi you might correct the actual dates, I was around at the time but Australia made a decision to build another reactor. Why did they make that decision? It wasn't just because we needed one, there was damned good evidence that we needed a reactor and there was some future proofing and also some business opportunity downstream. The fact that the Americans stuffed that decision up, that's their problem, right? They made a bad decision not to invest in reactors back then, as the Canadians did, and then they came up with some strange idea of a very fancy reactor. I think that they stuffed the

decision up is not justification for us not having a reactor. They should have had a reactor, they know they stuffed it up, 20 years ago they made the wrong decision. It's probably too expensive or maybe they think it's too expensive, but let's not pretend they mucked up a very big decision, both the Canadians did it and the Americans did, Chalk River failed, now the Nordion one, it failed dismally, their decision was a disaster. They were forced into cyclotron research to try and recover the mess that they made.

Australia on the other hand in 2000 made a damned good decision and it's lived with that, let's be proud of that, (38:11) supply chain. Peter just as a matter of interest this notion of importing, it's a bit like saying New South Wales imports from Melbourne, America imported from Canada, I mean, you know, you've got Canada there and you've got the Mayo Clinic down there about 50 kilometres apart, it is importing but it's really not geographically it's not a big deal.

Dr Adi Patterson: Well we're sending to the US.

Professor Barry Elison: No, no, no, we're talking about importing before, the Americans importing.

Dr Adi Patterson: Its three dimensional.

Professor Barry Elison: It's sort of Canada.

Dr Adi Patterson: I think what we're going to see, and this is exciting, we are going to see more cyclotron-based modalities and the theronostics are dependent on some degree on really us becoming very, very good with cyclotrons and I think the investments over the next few years will be dominated by a combination of some specialised investments to expand the capacity at Lucas Heights, for local and international use, and I think we're going to see a renaissance in accelerator-based technology, whether its cyclotrons or lunacs [39:08] one can think and decide about that.

I think we're going to see new micro X-ray type of technologies to replace the current set of lunacs within 15-20 years. Some of that could be developed at the Australian Synchrotron, that's really exciting technology. Perhaps we'll get particle therapy sometime which is also based on accelerators.

So we need to live in an accelerator world and reactor world and that's the best place to be because you're optionality is maximised. To say that you need to have one and drop another or vice versa is actually the wrong argument. What we're looking for is the best mix for a country of our size to be able to respond to the changes globally.

We're a late follower in particle therapy. The US is you know already completed their proton investment and they've just decided to move to carbon. Japan I think quite wisely chose carbon therapy and is now maximising that across the country. The little

country that sounds like Australia, called Austria, already has a carbon therapy facility which it'll open this year.

So we must recognise that it's not just about diagnostic and therapeutic nuclear medicine, accelerators are going to transform medicine in all sorts of other ways and we've got to be in touch with that and reactors are also going to play a role in that. So for me the wonderful part of this debate is our clinical community benefits from the best access. We don't have a supply chain that can easily fall over, we have rapid adoption of new technologies from all over the world because we've got the nuclear capacity to process these materials in a reactor environment. That is a little bit more challenging than in the PET environment but at the end of the day its chemistry with slightly different levels of activity, they have exactly the same underpinning technologies.

So for me, I don't think it should be a wedge debate, it should be embracing of both.

Professor Barry Elison: Here, here.

Dr Adi Patterson: And embracing the risks of both. Now the waste risk in reactors is clearly higher but is it scary and frightening? No, it isn't. We recently had our colleagues from the Champagne region visiting in South Australia to show that the makers of champagne had no dis-benefits from having a waste management facility in France, why do we have to make it scary? That doesn't seem to be the bipartisan position that has been established for at least a decade is that we need to be responsible users of the technology and if we want to make them scary, then we're not really having a rational, science-based debate.

Lyn Angel: Look at Adi on that note, I know we're a little early but I'd like to ask Michael to close it shortly but for me as the non-expert moderator, those sentiments really encapsulate so much from a community-minded person and a consumer-minded person, in terms of that Australia that I would like to see the view is that commitment in the scientific community and then if we make it political, in the political community, that we are looking to embrace all the best of the technologies, that we have got the expertise in our country to be able to doing, but not in isolation, we are no longer isolated countries, we are players in the global field and I think we risk our place in that sort of international community if we do try to not seriously consider our responsibilities in that sort of environment.

So I think in terms of consensus I'm going to be wrapping up now. I think it would be quite clear that we'd have consensus that the nuclear medicine production still has a place in the health of our communities, not in isolation but has a place, is there consensus on that?

Dr Peter Karamoskos: The question is technician-based nuclear medicine so the practice of nuclear medicine, not its production.

Lyn Angel: Okay, and that would be committed a consensus to Australian research still being done by ANSTO and others who are leading that debate to ensure that the best technology that is available to patients and therefore the health of the community continues to be explored always at that notion of the benefits and risks being weighed out in the new technologies but then on the case by case basis so again, I feel that that's been something that's been echoed around the table.

Dr Margaret Beavis: I just want to say one thing in that if it isn't scary, why not leave it in Sydney?

Dr Adi Patterson: Because you don't want to mix up a research facility's mandate, it's like leaving all the medical waste that comes out of a hospital next to the hospital. We're a research facility, we're there to develop techniques to understand the environment and to understand human health, to be able to provide a wide range of benefits, if you take a really small footprint site and gradually fill it up with the waste and don't move it responsibly to what the international community agrees is a place where it can be managed, you're actually moving the research mandate at ANSTO away from what it is. ANSTO is expanding still and so has got a range of stakeholders who want to use the facility and therefore to responsibly manage the waste and move it to a place where it won't be any more scary than it is at ANSTO, it's definitely not scary at ANSTO either, but it's not the main mission of the organisation to manage waste, the main mission of the organisation is to provide nuclear science and technology benefits to our society and that we're doing all of the time.

So it's a muddled argument frankly to say "all waste must stay exactly where it's produced," then we're not going to do anything as a society.

Dr Margaret Beavis: I think there's a number of arguments that go around that but I think ANSTO has been given by the government capacity to store this waste to well into the 2020s, the site

Dr Adi Patterson: That's not accurate.

Dr Margaret Beavis: No we supported the government's submission last year so that's going ahead.

Dr Adi Patterson: That's the interim storage because we don't have an (44:46)

Dr Margaret Beavis: Tell its interim storage, The National Waste Repository is also interim storage, there's 100 years planned, it's not disposable.

Dr Adi Patterson: Well low level waste -----

Dr Margaret Beavis: Its very poor quality plan.

Dr Adi Patterson: Low level waste is a final storage facility.

Dr Margaret Beavis: But for the intermediate level waste is where most I think more than 90% of the radiation is so this is an important -----

Lyn Angel: Margaret it's good that you've raised this because -----

Dr Margaret Beavis: Yes I'd like to be able to do it -----

Lyn Angel: I'm quite sure in the future we will have a webinar which has actually got a focus on waste. This is now moving us away from the focus of today's session and so on that note, as I would like to actually bring this to closure.

I really would like to remind our viewers that you still have the opportunity to put questions forward. Clearly they haven't, may not all have been answered today, keep them coming because I know there is a commitment that they will be taken away and considered in relation to the theme around this session today and that the responses will be accessed publicly.

I do want to thank our panel members. I know Michael's going to be doing it but it has been a long day. I really, really appreciate the focus, the commitment, and the passion and the knowledge that everybody has brought to this discussion. I have learnt a lot and thank you very much for entrusting this role to me and I'd like to invite Michael to actually close the session for today. Thanks Michael.

Michael Sheldrick: Okay, thank you. Yeah look, I can only echo the thanks Lyn to the whole panel so Dr Beavis, Professor Bailey, Professor Elison, Professor Angel, Professor Kiat, Dr Karamoskos, Professor Currie and Dr Patterson and I won't forget Francois Couillard who has brought an international and slightly, well an international perspective to what is an international issue but one that we're grappling with here in Australia, I can only thank you all very much, it's been a privilege to be associated with a group of people with the capacities that you have and we really value the contribution that you've made to our commitment to the public in Australia, both to the local communities that we're talking to, but also to the broader community to put facts on the table to allow them to make decisions.

We've been right from the start of this process around citing the facility and very clear that we will not impose this on an unwilling community. We're not telling the communities what to think, we are doing our best to provide information to the communities so that they can make up their own minds. We're still in a decision-making process for all of the communities where they are still to decide whether or not they wish to proceed, so the hours that have been spent today from all of you on a voluntary basis, really do appreciate the information that's now been put into the public domain and can now be further discussed and if we get some feedback or some reactions through either the video that people can watch later or directly, that would be much appreciated and we'd be happy to address it at the time.

So look, on behalf of the Department and the Australian Government, I'd like to thank you all, I appreciate the time you spent discussing this important topic today and close

it up and say thank you very much and I hope that the people that are watching this either now live or subsequently get the same value out of this that I have got out of it as well, so thank you very much.

END OF RECORDING (48:04)