COMMISSIONER: Good morning. I welcome you back to the Royal Commission on nuclear fuel cycle. Today we move to a new topic, topic 21, Regulatory Oversight, and I welcome from the United States Mr Donald Hoffman from EXCEL Services Corporation, the president of that particular corporation. Counsel.

MR JACOBI: Effective regulatory oversight of nuclear activities is essential to ensure the safety of protection of workers, the wider community and the environment. By its terms of reference, the Commission is expressly required to consider the regulatory arrangements which might be necessary to facilitate and govern further involvement in each area of the nuclear fuel cycle in South Australia. The starting point for that analysis is that at both the federal state level there is a body of existing legislation which variously prohibits, controls or regulates nuclear activities. The most significant regulators are the Environment Protection Authority and the Director of Mines.

At the national level, ARPANSA and ASNO are the regulatory bodies respectively responsible for radiation protection, physical security and nuclear safeguards. Bearing in mind the legislative prohibitions in some areas of the nuclear fuel cycle, there are not existing regulatory systems that would appropriately manage the full spectrum of nuclear fuel cycle activities that the Commission is required to consider. In contemplating whether there is potential to expand into these activities, it is necessary to consider the regulations developed as part of the international framework.

Australia is a party to a range of international treaties and conventions which are directed toward or bear upon the regulation of nuclear activities. Further, when considering the substance of the regulatory regime which might be required, the Commission can learn from regulatory models adopted in countries with existing nuclear programs around the world. In considering those issues, the task for the Commission is not to comment on existing regulators, but to identify the guiding principles relevant to the development of a regulatory regime in which the public would have confidence.

During this public session, the Commission will consider regulatory regimes operating in other countries and identify the key characteristics of an effective and robust nuclear reactor regulator. The Commission will also explore existing regulatory arrangements in order to better understand the changes which may be required should South Australia embark on new nuclear projects. The session aims to draw out evidence relevant to developing an effective regulatory regime in South Australia and Australia in the event that South Australia expands its participation in the nuclear fuel cycle.

Mr Donald Hoffman is the president and CEO of EXCEL Services Corporation which he founded in 1985. EXCEL Services provides specialist advice and

support services to nuclear facilities in the US and internationally with respect to operations, engineering, safety, licencing and regulatory issues. Prior to this, Mr Hoffman was a branch chief and lead reviewer at the USNRC and engineering officer on a US navy nuclear submarine. Mr Hoffman served as president of the American Nuclear Society from 2013 to 2014. He currently provides presentations on the benefits of nuclear science and technology to the US congress and is chairing a committee to support all the US governments on committing to the US Clean Energy Act and addressing the climate control acts, and the Commission calls again Mr Donald Hoffman.

COMMISSIONER: Mr Hoffman, were we minded to participate in some of the activities of the nuclear fuel cycle, can you step through what our first steps might look like if we were to develop a credible and robust regulator?

MR HOFFMAN: Certainly, sir. If I may, I'd like to at least give you guys some information that may inform some of the decision making and some of the information I'm going to share with you, if that's acceptable. When I was the Nuclear Regulatory Commission I was the director of the group that was responsible for reviewing the licence applications for those plants licencing in the United States immediately post Three Mile Island; that is, from 1980 to 1985. During that process, we acknowledge and recognise that we needed to take a somewhat different approach as we were implementing not only the post Three Mile Island experiences and the lessons learned, but also new regulatory requirements which contained therein.

As a result of some of the public considerations and things of that nature, we did revise and address those approaches and those have been somewhat the basis of how the Nuclear Regulatory Commission has gone forward since then. So in 1980 to 85 we were responsible for creating a lot of that and we used a great deal of best practices that we could discern from the international nuclear community and specifically from things that we had learned that worked both well and those that did not.

And so the answers that I'm planning to give to you guys during the course of today are informed not only by what we've seen in the NRC over the last 30 to 40 years, but also what we've seen in the entire nuclear regulatory community in the last 30 years plus, and the activities that we've seen and it worked well and those that have not and why, acknowledging and recognising that some of those are country specific and business specific, and I'm going to try to bring to you a sense of how that might best work for the country of Australia given what I know about your regulatory authority, ARPANSA, and the activities you currently conduct, and then with the questions that you just asked, Mr Commissioner.

So with that, in the slide presentation that you have in front of you I will just

jump to the activities from what you have asked. If you're going to move forward from any kind of activity of the fuel cycle, whether you're going to be considering an enrichment facility or you're going to consider some kind of mining or manufacturing activity above and beyond what you're doing now, if you're going to move forward with marks or, for that matter, with a power facility, you need to consider what you need to do related to the activities to have a robust regulatory authority, as stated in your statements that you made earlier.

So there are a number of things that come into mind. When you decide on this, there are a number of ways in which you can establish a regulatory authority. There are a number of regulatory authorities throughout the world, and, as I understand, you're going to have a chance to hear from Mr Loy after me, who has had specific experience there in ARPANSA and of course with FANR in the United Arab Emirates. So I'm going to try to minimise my reference to FANR, except how it's important to reference something, and try to reference more from what we've seen from the regulatory authorities, if that's acceptable to you, Mr Commissioner.

COMMISSIONER: Yes, that would be great.

MR HOFFMAN: Excellent. So what should it address? When you're looking to set this up, you need to have a national policy for planning. You need to set this up first, and you're going to go through this, a mechanism that establishes what you're going to do, what guidance is available, what are you going to utilise, what treaties need to be gone into, the strong need for the national policy and the programs. All of this is outlined in some of the things you have in front of you. Obviously a decision to move forward with any kind of this activity can and will be, especially if it's a nuclear power facility, a 100-year commitment. So it needs to acknowledge and recognise the significant amount of efforts that need to be conducted in what order, by who, who's responsible, who's accountable, what are the metrics and measures for you be able to confirm that indeed you've been successful in moving forward.

This national nuclear policy document is utilised. It actually gives you a sense of a number of activities that are going to be conducted, and it can be based on a number of things, including what I call NGG 3.1, which is a milestones documents which comes out of the IAEA, which we actually assisted in developing. But the next step is to build a robust regulatory authority, as you have stated, and that is the most important precondition moving forward.

I call your attention to slide 12 of the revised slide presentation that I gave you. The entire international nuclear community is watching everyone who is embarking on any kind of nuclear build program, and the reason for that is obvious. Any kind of event anywhere is an event everywhere, and we in the

international nuclear community have to be assured that all the new nuclear build countries have the capability and the competence to move forward in such a manner as to ensure the overall safe operation of whatever nuclear facility they may be embarking on placing into operation. And so as a result of that, there have been a great deal of efforts to facilitate a coordination of information to be brought together, and best practices, to try to share that information with those entities and organisations, really not only for their benefit, but really for the benefit of each and every one of us.

So if you look at phase 1, the safety infrastructure, before deciding to launch a nuclear power program, this gives you a time frame how you might move forward, if you have a positive decision and all the phases you will go through.

If you're going to set up this regulatory infrastructure, then there are a number of conditions and characteristics, which we will get to shortly about them, but the important thing is to acknowledge and recognise and there's a great deal of variation throughout the rest of the globe on how regulatory infrastructures can be established. ARPANSA is currently a radiation protection regulatory authority. I work very closely with them in licensing your OPAL research reactor and decommissioning HIFAR, so I am very familiar with their actions, their activities, how they monitor and oversight your current licensees in that activity. In order to move forward from this you would need to make a significant commitment to expanding significantly how that might look.

If you go to slide 14 you will notice that we have a slide that lays out for you the steps of how you would structure a robust and credible regulator, and those six steps give you a sense of the kinds of activities you would conduct and the requirements. Now, make no mistake about it, there's a great deal of information behind those, but it just gives you a sense on the approach that you may take. That's also true of slide 15, which tells you the kinds of ratification of key international treaties you would have to go through, what your national atomic law would look like is also on slide 16.

MR JACOBI: Mr Hoffman, can I just interrupt there.

MR HOFFMAN: Certainly.

MR JACOBI: I notice in the notes you have produced - sorry, we're getting some feedback.

MR HOFFMAN: You're getting some feedback.

MR JACOBI: Yes.

MR HOFFMAN: You mean in my talking to you?

MR JACOBI: No, it's all right now, it's cleared up. In the notes you have produced to us, you have made reference to the fact that some commercial vendors will not deal absent certain arrangements. I am just wondering whether you could expand on that point.

MR HOFFMAN: In order for you to embark on nuclear activities there are certain treaties, depending upon what activities you will conduct, which will have to be signed. We could go into more detail. I'm not sure you will want this now, but essentially what this list provides you is the kind of treaties that you would have to consider embarking on that are international and, for that matter, national treaties and agreements with the rest of the international nuclear community in order for you to move into these kinds of engagements.

MR JACOBI: I'm interested whether you could just pick up on there's a reference to the limits that are fixed by the Nuclear Suppliers Group and I am just wondering whether you could just very briefly just expand on what that limitation is in terms of what those particular requirements are. This is in - - -

MR HOFFMAN: Which one - I'm sorry.

MR JACOBI: In your notes at number 16 there's a reference to vendors belonging to the Nuclear Suppliers group not being willing to supply absent certain minimum requirements being in place. I am just wondering whether you could briefly expand on that.

MR HOFFMAN: You're talking about slide 16. Which one are you specifically asking about, sir?

MR JACOBI: Sorry, it's just that the section that's highlighted in yellow refers to nuclear vendors who belong to the Nuclear Suppliers Group would not be willing to supply absent certain minimum requirements. I am just wondering - - -

MR HOFFMAN: I understand. Thank you for clarifying. I'll take a moment. There is a Nuclear Suppliers Group, NSG, which currently has 46 countries that are engaged in activities related to supply, and what they have done is they have established a minimum set of requirements in addition to those required by the International Atomic Energy Agency for those requirements for them to be suppliers, to ensure that there's a minimum criteria for the kinds of supply that one would expect to go to those countries embarking on nuclear programs, whether they're enrichment facilities (indistinct) facilities or nuclear power plants.

MR JACOBI: There's also reference to a need to establish certain bilateral

agreements with the NPP vendor country. I am just wondering whether you could just briefly expand on what that's a reference to.

MR HOFFMAN: That is a reference to different requirements that you may have. For example, as you make your decision related to which techonology you would select, there are a number of variables that you would utilise. In doing so, when you get down to your final decision-making related to whatever two or three technologies you finalise on or that are the most applicable for your utilisation and application, then you will begin to interview those (indistinct) organisations and then get into some kind of EPC agreement and a negotiation phase.

In order for that to occur, you must have bilateral agreements with those countries that they can transfer that technology from their country into yours. For example, in the United States we have three different treaties that we address that are specifically important for this. The first is the 123 Agreement that comes out of the IAEA rule related to nuclear non-proliferation. The second is what we call 810, which comes out of the DE810 requirements related to technology transfer for what application, how is it going to be used, what can be shared to what entities, when, why, how and so on and so forth. The third one is under our Department of Commerce we have certain specific requirements related to US technology providers that they have to meet in order to be found acceptable by the government of the United States to transfer said technology.

All governments in the world have such. They vary in number, they vary in requirement, they vary somewhat in their specific limitations but they do exist. So what we're saying here is in order for you to embark on a technology transfer from some other country there are certain treaties, both bilateral and in some cases trilateral, and other activities that you will have to engage into before you can have that technology transfer to Australia.

MR JACOBI: I was just interested to pick up, you have referred to the IAEA milestones and I am just interested to understand. We understand that they need to be customised and I am just wondering whether you might be able to point us to some useful examples of customisation and what it is that needs to be customised.

MR HOFFMAN: The kinds of things that would be customised is the different applications and utlisations of whatever you were going to do. As you know, there are a number of different technologies out there now and it really depends upon what aspect of the fuel cycle are you going to. Are you intending to go into a nuclear power plant program where you're actually going to have a new nuclear power plant build, are you also going to intend to do enrichment, are you also intending to do other some kind of back-end activity,

are you planning to acquire a technology which also utilises a fuel, plutonium, there are so many variations on what you made do.

Because of the different technology types and their application you have to consider what kinds of agreements you have to get into. So if you look at the IAEA milestone document, it lays out a very overarching review of the kinds of things that you would want to see and need to see, but it doesn't give you the specificity of how that would apply, so there are certain unique aspects that really have to come along to help you with it.

For example, there are several countries we've helped that have decided to embark on a small modular reactor program which did more than just energy. In some cases they had activities that developed industrial heat, did desalination, and in one particular case they wanted to do hydrogen production, so as a result there were different requirements that had to be met for those particular applications being utilised in said country.

MR JACOBI: I just wanted to pick up on the idea of the extent to which harmonisation with the licensing requirements for fuel cycle facilities in nuclear power plants is an objective that should be taken into account in the development of any new regulatory regime so that there's similarities in any new country with regimes that apply elsewhere in the world.

MR HOFFMAN: What we have done and what we have seen is that the regime should be set up in such a manner and way so that it can address whatever your intention. If you have identified in your particular country that your intent is to do X, then your regulatory regime will be structured to facilitate as a minimum the capability to oversight from a regulatory perspective to provide for the public health and environmental safety all the activities that will be conducted therein.

If you have decided that you would rather take a somewhat broader approach, then that will require your regulatory infrastructure to also address that broader approach. There are certain minimum elements that all regulatory authorities must have, and then beyond that, depending upon what activities you're going to conduct, those may be additional to the regulatory authority's capabilities and confidence which need to be established.

MR JACOBI: I am just wondering about the extent to which in setting up a regime it might be important to borrow the standards that are used elsewhere so that both those that are seeking to operate and develop plants have a similar experience in a new country as they would in their country of origin in terms of having licensing carried out or conducted.

MR HOFFMAN: I don't want to get too far ahead of myself because you have

a question that addresses that.

MR JACOBI: All right. I'm happy for us to come to that later. That's all right.

MR HOFFMAN: I am more than happy to do it. I'll just give you a sense that the licensing or design certification in the country of origin, the more that you can provide some kind of similar infrastructure to address that, I do have slides that specifically show you what we have done in other countries. In fact, we have actually been developing, as you are going to see, a document which enables regulatory authorities, whether they are just newcomers or they have either a great deal of experience in rectification with a different kind of technology, let's say a country in Eastern Europe which has a VVER, Russian VVER 440 or 1000, and now they have decided to - and there are some that are doing this - to now licence a Westinghouse AP1000.

The kinds of initiatives and activities they need to conduct are very important to ensure that there's an approach which acknowledges and recognises the benefits of whatever licensing and design certificatons are current in the country of origin, but also gives assurance to all the stakeholders there's a sufficient level of review despite that in that area and allows you to focus on those areas which are most important for the particular application in the country.

MR JACOBI: I will come back to that in a minute. We have heard and we read in the Milestones documents, references to there needing to be an independent, vigilant and transparent regulator. We are just interested to understand what that actually means in practice? It is one thing to state the principles; we are interested to understand what that does actually mean when they operate?

RESPONDENT: Well, the important thing is that if you are talking about independence and transparency, what that means in practice is that the activities that you conduct are completely independent. For example, in some countries that we went to we discovered there was a minister of –in some cases it was a Minister of Commerce that was responsible for the nuclear programme and then that was transferred to a Minister of Energy in some countries, this has just recently been set up. But that Ministry of Energy had a responsibility for oversighting both the energy generation and production element in the country and the regulatory authority. That cannot be. You must have a completely independent reporting chain to ensure that there is no bias decision making at any level of your government or oversight that could influence the fact that safety is paramount. And while we would not expect that to occur, that is part of the reason why we talk about independence.

So independence means that your regulatory authority is independent of any other influence, other than that which is under their mandate, which is to provide for the public health and environmental safety. The transparency means that the conduct of their operations is transparent. Now what does that mean in practice? That means that the development of their programmes, their processes for technical review, evaluation and inspection are all clearly established and set out and programmatic requirements which are accessible and available to the public, all stakeholders and for that matter, the licensee or the regulator, if you will. This enables us to have programmes and processes that can be clearly utilised in a transparent manner, so people understand what to expect. That provides for predictability and stability in a regulatory process but also a sense of transparency. This way, the stakeholders don't expect that on Tuesday X is done and on Thursday Y is done. What this basically establishes is a standardised approach which ensures a consistent, fair approach to regulation to ensure the public health and environmental safety is maintained.

MR JACOBI: Can I pick up, are there any other aspects, putting to one side issues of independence and transparency that are necessary for a credible regulator?

MR HOFFMAN: You are asking me why is this necessary?

MR JACOBI: No, sorry. In addition to independence and transparency, are there any other characteristics that are important for a credible regulator?

MR HOFFMAN: Well certainly, and I tried to give you (indistinct) that, it looks – if you were turn for example to slide 20, you will see that we have tried to lay out what some of the kinds of characteristics one would expect to see. These are characteristics that are based on one, the kinds of documentation that we personally have prepared and seen in applications but also two, the experiences from the rest of the global nuclear community, that in many cases have actually been documented in different forms, either in guidance or in informational documents and things of that nature. An example would be SSG16 which is a characteristic document of regulatory authorities that is issued by the International Atomic Energy Agency; so some of the characteristics are a complete operational transparency. As we discussed, the issue of capability of performing other activities in such a way as everyone understands there is a predicted one stable approach.

The second is the highest standards of nuclear non-proliferation. Ensuring they understand totally that what they are doing must only be in a most safest and commercial applications and use. Third is the highest standards of safety and security. You cannot eliminate really when you look at it, there are three S's that are always important in any kind of nuclear programme, safety, security

and safeguards because you are constantly looking at it from a perspective of the overall safe operation of the facility, the physical and cyber security of the activities that are contained therein for that particular application or activity and third, the actual safeguards activity. The safeguards not only the activity in itself and the entire plant, whatever kind of plant that may be, but also ensuring that there is no mechanism where you can actually have the proliferation of these that could be utilised for kind of a nuclear weapons application.

A direct connection with the IAEA because it is important to have that because you are constantly in a guidance perspective. IAEA does not develop regulatory guidance but it does utilise best practices and does bring together the people from all over the global nuclear community. So you want conformance to those standards. Partnerships with governments and companies that are in the responsible nations, if you are going to be developing this and moving forward with any kind of technology that comes from another country, you need to have the collaboration and cooperation of that country's regulatory authority, that country's (indistinct) of choice and that country's activities related to the suppliers, whichever suppliers that may be, to ensure everyone is on the same page approaching this in the most appropriate and consistent manner for your perspective. And then an approach of the peaceful domestic nuclear power programme that best assures the long-term security and stability of your activities.

So this, plus the fact that you have to implement all of the obligations under the relevant international treaties conventions and agreements, the fact that you have to have the regulatory authority must have the authority to determine all matters related to public health and environmental safety. In other words, that means they must have the physical and the policy decision making authority to tell the facility that they must stop operation or they must do certain activities based on their evaluation of where they are and that facility must therefore comply with whatever requests are made and their response to addressing regulations and licences. So if you go through all those slides, all the way up to 22, 23, you will see that it basically lays out the kinds of things you would expect to see.

MR JACOBI: I want to pick up on one of the comments that is made in the notes, it is a reference to the regulatory culture and I am just interested to understand your views about when it is important to establish a regulatory culture and how one might go about thinking about the idea of establishing the sort of regulatory culture that you would want?

MR HOFFMAN: Interestingly enough, and not all regulatory authorities are created equal, I have the privilege of working with 27, and now 28 over the last few weeks, regulatory authorities throughout the world and they don't all do business the same. There is a variation on that theme and in some cases that

variation is country specific because of the unique manner in which they do business. In other cases, it is because that regulatory authority in its formation, through whatever activities, doesn't necessarily approach everything in the most appropriate approach process that I would want, or I would expect as an individual and as an expert professional in the nuclear power industry. And what that means is, well you are talking about an appropriate regulatory culture. A regulatory culture is developed and regulatory culture is a true culture, like we talk about safety culture. It is a constant way of doing business and a constant way of agreeing and addressing issues from the top down and the bottom up, in the most appropriate manner and I will give you some examples of the kinds of things that can happen without the appropriate regulatory culture.

There are some countries where the regulatory authority does not necessarily understand all of its own regulations itself and as a result is overly prescriptive and burdensome and actually stands in the way of the safe and businesslike operation of the facility instead of being a regulatory authority whose responsibility is solely the assurance of the protection of the public health and the environmental safety. And in doing so, that actually makes the agreement relationship between the licensee or the regulated and the regulator a little more stressed than it needs to be. There are other countries where the regulatory authority is much too willing to accept whatever the basis of what the licensee or the regulated gives them without a full enough evaluation of confirming in their own right that indeed, the information provided thoroughly justifies the actions or activities that they are proposing to conduct. And this has existed in varying levels over the last decades throughout the world and many of those issues are being addressed as we speak but some are not as completely resolved as I know I personally, and I am sure others would say they would like.

So if – when you have the opportunity to establish a new regulatory authority, the importance is establishing that regulatory culture which is acknowledging the responsibility again for the public health and environmental safety in ensuring that its focus is constantly always on that issue and that issue alone. And the reason that I say that is because in some cases I have seen where a regulatory authority has required, and I am going to try to give you something that just gives an approach to it, a $500,000 fix to a $5 problem, which in my opinion is contrary to safety culture and contrary to regulatory culture because what you have done is you have totally skewed the issue of regulation versus safety. So the regulatory requirements which you establish and you would require the licensee or the regulator to adhere to, must be consistent with the activities that licensee or regulated entity is planning to conduct and the safety thereof.

MR JACOBI: Do you have a view as to whether there are any particular regulatory organisations around the world that you consider to be effective that

are Australia ought to look to if it were minded to establish new fuel cycle activities?

MR HOFFMAN: There are variations on that theme. If you look at the United States NRC, which is considered the gold standard, it is a very prescriptive activity. I'm going to say "we". The United States nuclear regulatory infrastructure regime has been changing over the last two decades. Initially it was a verbatim compliance, unfortunately, equalled safety. I never personally, nor do I now professionally, agree with that. There is an acknowledgement and recognition that regulation should establish the specific regulatory requirements and limits and that there should be guidance documents which allow for flexibility on how compliance with those may be demonstrated, because invariably as the technology improves, as information improves, as experience improves, we find that there is more than way to comply with something.

In many cases, if we're overly prescriptive we actually become overly burdensome and we preclude innovation and we preclude even better approaches towards compliance and safe operation of a facility. So I believe there needs to be a balance in there. The US is working towards that. This is one example. If you take the UK, which is more of an outcomes-based approach, the problem with that is that it often, as you'll see in some of the slides, it leads you to not necessarily have predictability and stability of what the requirements will be until the very end, and it really precludes a sense of what applications need to be done and how. Now, that doesn't mean that it doesn't work in some variation in the UK, and it does work there to a certain extent.

Then there are variations on that theme where you have one spectrum to the other. Another example is the regulatory authority in Sweden, which states as long you adopt just one regulatory approach and all the rules, regulations and requirements therein, they don’t specifically dictate which one you can utilise. The problem with that, from a regulatory authority standpoint, in my opinion, is that you may now have entities and organisations that you are regulating that are doing the exact same nuclear safety application but with a different mechanism for complying with it, and you have to keep the variation between the two addressed, or three, as the case may be, and by working with that regulatory authority, we're working towards finding a more consistent standard approach.

Take STUK, for example, in Finland. They are a very robust regulatory authority, so much so, as you know, the Saudis actually hired them to assist them in their activity of setting up their regulatory infrastructure, and for that matter, STUK hired us to help them help the Saudis. So we worked very closely with STUK. They have what we call YVL guides, which are like

regulatory guides, but they acknowledge and recognise there needed to be flexibility in the overall regulation. STUK in Finland is a good example of a regulatory authority that you might want to consider somewhat modelling yourself after. However, even STUK has some country-specific things that I do not believe, based on what I know about ARPANSA and your current licensees, would work well for Australia.

So I think at the end of that I would say there is no one size that fits all. I believe that there are variabilities in best practices that you could glean from each of the benefits of each of the regulatory authorities that you could bring to bear to develop a regulatory authority which best fits the unique needs of the country of Australia.

MR JACOBI: I know you indicated before that you wouldn't deal specifically with FANR, but I'm interested in the notes, that they pick up the idea that because the UAE have only proceeded with respect to nuclear power plants that they've applied a subset. I'm wondering whether you could explain the subset sort of idea; that is, borrowing a subset from another regime.

MR HOFFMAN: I would be happy to. When the United Arab Emirates, with ENEC and FANR, were first establishing their program, we as a company were hired to develop the licencing the approach and strategy for the entire activity for licencing Barakah 1, 2, and then eventually 3 and 4. We established a mechanism and approach predicated on what we had seen in the USNRC, what we gleaned from the way the activities were conducted in Korea, given the fact that it was a APR1400, what we've seen from other regulatory authorities who brought that to bear, and what I'll call, as you stated, an integrated approach utilising some of the best practices that were known at that time frame in 2007 from around the world.

So eight years ago there were a number of things that were known at that time that had been utilised, some more successfully than others, that were brought to bear. Then during the application and work in the United Arab Emirates and the actual utilisation and application of those processes, we began to revise them based on what we saw, what we worked, what didn't, because some things were more theoretical than others. And so, as you said, the actual application will actually in some cases be borne out, but they were minor in that form and format.

So the United Arab Emirates, and I'm sure that John will express this, is a unique and, I think, a very successful approach towards establishing a regulatory authority which is consistent with the utilisation of best practices throughout the globe, and also an approach that is uniquely based to address the needs of doing business in the particular country, in this case, the United Arab Emirates.

MR JACOBI: I just want to pick up, in terms of time frames, your notes at number 29. We're interested in understanding your view about the sorts of time frames for a regulatory set-up, and also to get a bit of an idea about what you think the changes are likely to be at particular points as you work your way through the regulatory phase; that is, the point of receiving an application and so on, and dealing with licence applications.

MR HOFFMAN: Certainly. You know, in some cases in the world right now, there are regulatory authorities that are being set up that are actually holding up the process. Vietnam is a perfect example. And forgive me if I'm going to be bold with you. I'm not entirely sure my clients in all these countries will appreciate my statements, but they are statements that I would make to them to their face too. So there are countries where the actual regulatory authorities' inability to be set up in a form and a fashion in a quick enough order are done soon enough in advance of the activities has actually caused significant delays to the approaches and moving forward.

So what you have is a design which has been licenced in the country of origin has been licenced in several other countries but cannot get licenced in a particular country simply because the infrastructure, the format, the content and detail of the capability of that particular regulatory authority does not yet exist. So when I say these time frames, I believe - and I use T as the first NPP contract award. In other words, you've gone through your siting determination and selection. You've gone through your technology evaluation and taken the technology evaluation from either a large build, small build, down to a select few. You've negotiated those contracts. You decided where you're going to go, and now you issue that contract for them to proceed forward.

I believe that the regulatory authority should have been set up 12 months before that, and the reason for that is to give them time to actually start establishing what are the regulatory requirements in that particular country. In other words, you need a time frame in which you've established what are your laws, your regulations, and what are the actual regulatory requirements that you're going to establish on whatever model you utilise so it's clear when you're going forward. I'll give you an example of that.

In one particular country we discovered the regulatory authority itself did not understand all of its regulations, so we did what I call a compliance matrix. We developed a matrix which laid out, first, every single regulatory requirement in that particular country. Second, we laid out a gap analysis between that particular regulatory requirement and the IAEA overarching standards. Then third - - -

COMMISSIONER: We'll adjourn until we've resolved these technical problems.

ADJOURNED **[8.39 am]**

RESUMED **[8.42 am]**

COMMISSIONER: We appear to have resolved our technical problem. We'll go back to the previous question.

MR JACOBI: Mr Hoffman, I think we were discussing the issue of time frames and you were offering an explanation as to what had occurred in terms of doing an analysis of gaps and understanding what a regulator needed to do in order to understand the full scope of its regulations.

MR HOFFMAN: In order for the regulator to be capable and competent in the time frame in which the regulator needs to be in such a manner as to not unnecessarily delay the overall program from moving forward from a perspective of either the country and its government and/or the actual vendor provided set-up activity or application for you, they need to have started their program at least 12 months before you have issued, as I said, the first contract award date.

This is important, as I said, from the perspective of giving them time to develop the regulatory requirements that come out of your national laws, and also to have done the training, the mentoring, developing the programs, the processes, the procedures, for not only review but also inspection and confirmation. What I was going to give you was an example of a compliance matrix and maybe I will go back to that in a moment, but I do want to say that what you're going to be seeing is, you're going to have to be responsible as a regulatory authority not only from the review of the vendor's technology and the design certification or licensing in the country of the origin, but also the supplier's activities from their construction, their activities.

MR JACOBI: More than the matrix, I'd be interested for you to explore what you consider the steps are and the associated time frames are at the relevant points. The notes make references to certain periods of time for particular activities. I'd just be interested in a brief explanation of those periods of time and the work that would be expected to be done within them.

MR HOFFMAN: The initial part, if you're talking about the first 12 months, then you're talking about the regulatory authority set-up. During that time frame there are a number of things that must happen. (1), you must first develop your regulatory requirements, understand what is your regulatory regime, what's it based on. For example, you have an overarching regulatory

requirement through your current ARPANSA as a radiation protection regulatory authority. Now, this one has to be established to oversee and oversight all the activities you're getting ready to engage into, which may be fuel cycle facility (indistinct) facility, enrichment facility or a nuclear power plant, or some combination if not all the above.

In doing so, that regulatory authority has to do several things. (1), it has to establish an organisation. You have to establish who is the head of that organisation. Then you have to hire a competent and capable staff. That competent and capable staff, if you're utilising typically folks from the country that's doing this, if you're in any kind of new build you typically have people that have educations and some limited experience in this activity. So you have folks that have engineering degrees, construction activity and/or experience, and other folks that have been in radiation protection and things of that nature that you could utilise as a base group to put together.

So you need to structure your infrastructure so you have your - are you going to have a commission or are you going to have a CEO. Are you going to have a director of this and a director of that, are you going to have radiation protection, are you going to have engineer, are you going to have operations or are you going to have start-up, and there's a number of things that we have shown by application are better than others, depending upon the unique application of what country it is, and once you have established that and you bring in a group of people, then you need to train them.

You need to train and mentor them on what they should expect to see. During that time frame you are basically setting them up with the tools to be confident and capable to work alongside whoever your technical services organisation or whatever entity you have decided to utilise to assist you through the first several applications of this until you can make it, so that particular regulatory authority can stand on its own, and that should be your ultimate goal, that you have basically provided enough experience and expertise that your regulatory authority can stand on its own with just occasional utilisation of outside international experts.

But in doing that, you develop programs and processes so that the vendor that's been selected will know what they can expect related to inspection and also review of their technology. In other words, they need to know what are you going to expect of them, how detailed a final safety analysis report or preliminary safety analysis report, are you going to use like in the US where we have a part 50 and a part 52, or are you going to use a two-step process where you will issue a construction licence and an operating licence. Will you also issue a site permit, will you issue an environmental protection permit.

There is a number of different licences and permits and things that need to be

done during the licensing and permitting and you must understand what those all are in this set-up time frame. You don't have to have developed everything, but you must at least understand what all those are and have the basic essence of how you are going to approach it. So your regulatory regime is understood by you and also by the vendor of choice.

MR JACOBI: Just in very brief terms, I was hoping you might be able to take me to the last three dot points, just very briefly, in terms of what are the time frames that are involved in the next sets of steps in your view, and then just in very, very broad terms, what would be expected to be done.

MR HOFFMAN: If you look at the - there are four steps on page 29, basically three, and these are very, very oversighting. At the T plus 12 months you will have expected to have received a site permit, and that is basically you have already given some sense to what you think what sites are going to be acceptable from a hydrological, geological, meteorological and other application standpoints, especially from the perspective of the unique country characteristics of rock formations.

We have a number of different mechanisms where a nuclear facility can be built. They don't all have to be built on the same kind of formation or same kind of location, but there are variations of ones that are more favourable to build than others, and so when you get that - that review typically takes 18 to 24 months on that activity, and then you see we have provided a number of experts and selected TSO support, and all that is predicated on the kinds of things that we saw in the UAE and other countries which starts on really slide 31.

What's happening during that time frame, you're actually reviewing the application. Now, in reviewing that application for a site permit, there are certain minimum criterion characteristics and information which must be provided. Then you have to be able to have set up your criteria and expectations so that you have matrix and measures for what you'll find acceptable and what you want.

This gives transparency, stability and predictability to your regulatory oversight process so that when an application comes in people can have some sense of how long it will take, what kind of review you will do, how in depth, how technically astute it needs to be, and so on and so forth. This way everyone is consistent. This will cause me to quickly run back to this compliance matrix I talked about, if I may. By having some - - -

MR JACOBI: Sorry, can I just interrupt you briefly there. Would you be able to just take us to where we're looking at in terms of the final regulator staff size would be at the point at which you've got an operating licence. I am just

interested to understand the transition to that step.

MR HOFFMAN: Well, you see the final regulatory staff size, it really depends upon what approach you are taking. If you take your current ARPANSA staff size, it's relatively small because of the actual scope of their requirements related to the ANSTO operations and obviously your other licensees. But if you are going to have a regulatory authority that has the wherewithal to look at things like we talked about, whether it's an enrichment facility or marks or something related to a nuclear power plant, you have to have a capability and confidence to look at a variation of technical areas, including all of the areas in the engineering, mechanical, civil, electrical, also looking at instrumentation and control, looking at geological, looking at containment, looking at the operations. I mean there are so many areas – I didn't list them all here. I can certainly tell you them but I can send them to you if you would like - that you need to be able to address.

Now that doesn't mean you have to know everything about all these at the beginning, if you have the right technical services organisation that has the wherewithal to bring the unique capabilities to bear during these reviews because not all of these activities require a full time staff, they need just the capability to establish the wherewithal that indeed the approach is acceptable, consistent with industry standards and norms and is one in which the country can specifically accept based on their regulatory regime. And that is typically a 120 to 200 people and as you can see, that is where the operating licence application is typically at T plus 60 months or five years, that is because you have gone through the actual construction phase after you have got your construction licence application in step two, with a commercial operation date typically at T plus 96 months because you are going through the other activities.

MR JACOBI: Yes. Could I move now, I am just interested to understand, given the time, whether you have any views about the sort of workforce requirements that you might require – this is stepping outside the regulator necessarily and thinking about the size of the workforce that you might expect to have that could assist in the development and planning of a new nuclear build?

MR HOFFMAN: In the initial timeframes when you are first beginning – forgive me - you need to have an entity or an organisation that is typically about 20 per cent should be your staff. You could have technical services organisation up to and including about 80 per cent of the overall 100 per cent of your staff to do this. But the initial activity, if you look at slide 29 and then also the activities before we get over to 31, then you will see the initial size timeframe is going to be that you are going to be somewhere in the neighbourhood of about 40 to 60 people. Now if you take that from the

perspective that you are 20 per cent of that, then you are basically one fifth of 40, you are about eight of your folks as a minimum that you have actually got that are being experienced, being trained and that should grow over time. In other words, as you being to take further steps, more and more of the people should be actual not expats but more of the actual (indistinct) people there from your country that are being engaged and involved. What would lay down as an actual step process showing all the unique steps throughout a different process for each of the applications and the kinds of number people you would expect to see and some of that is laid out on slide 31. And then also if you go to slide 32, and I am sure that John Loy is going to share this with you, that you can see what you are expecting to see from a (indistinct) standpoint for both the owner/operator, the licensee or the regulated and the regulatory staff itself. So you may see 500 to 600 people in the owner/operator staff when you have 75 to 100 in the regulatory authority and then you will have certain education staff because you are actually continuing the education for research and development and the activities consistent with your actual institutions of higher learning.

MR JACOBI: I just want to come back to something that we were talking about at the start and to come back to the extent to which a country that would be importing technology which is licensed in its country or origin, the extent to which the regulator in which the country – in which the equipment is being constructed can place – the reliance it can place upon the regulatory work that is being done in the country of origin?

MR HOFFMAN: We have been working to find mechanisms whereby we could show the kinds of activities that one could utilise from a step point of licensing or design certification in the country or origin, so if you look at that and there is a question, I want to say it's question 7, where you ask what aspects must be independently assessed?

MR JACOBI: Yes.

MR HOFFMAN: When you are looking at a perspective of you are a regulatory authority responsible for the public health and the environmental safety, you are now being productive speed, you are going through presentations, you are going through training, going through mentoring, you are developing programmes, processes and procedures and now you have selected a technology. That technology arguably should have gone through licensing or design certification in the country of origin, or some combination thereof and hopefully it's gone through licensing and it's in operation somewhere in the world. But that is not the case for all the technology that you may currently consider, if you are going to embark on this programme any time in the next few years. So having said that, how then can you go forward as a regulatory authority? What we have been doing is looking at how we can go

back and look at this. A design certification document is about 10,000 pages, sometimes as much as 12,000 pages and if you can use this, you can expect that it will have gone through at least 24 and sometimes as much as 36 months of very rigorous and intensive review by the regulatory authority in the country of origin. So that regulatory authority has already done significant amounts of technical reviews, significant amounts of regulatory reviews and then developed their safety evaluations, predicated on same and that assessment is on record and you can utilise that assessment as a basis. How far then do you go above and beyond that? There shouldn't be necessarily a duplication of effort but the important thing for you to be able to do is to be able to utilise the information that has been created as a basis for your decision-making. And so what we have done, is worked with other regulatory authorities to decide how can we develop a mechanism so that you can utilise the benefits from what has already been done as a basis for you going forward as a new regulatory authority.

And so what we have seen is, it says how might a new (indistinct) technology take advantage of that activity. You can work closely with a regulatory authority in the country of origin and you can establish a criteria for the basis of using that DCD or licensing from the country of origin. That is based on what are your country's regulatory regimes? How did you establish what your regulatory laws were at, all the way through governmental level and now what regime are you utilising from your regulatory authority? What that means is that we have developed mechanisms where you can see there are areas which you can utilise for the most part from the country of origin, regulatory authority and do a confirmatory assessment and analysis and others where you will spend a greater amount of time confirming the actual application and conformance to your regulatory requirements and your country and assurance for the public health and environmental safety.

So this reliance has been something that we have utilised in some areas, for example – and I am sure John is going to tell you about this, when they utilise the APR1400 it was not yet, and is still not yet, licensed or design certified in the United States but it does have licensing and design certification in South Korea. So they utilised that as a basis for a number of their reviews. In some cases they went above and beyond significantly, in some not so much because of the uniqueness. For example, the physical characteristics of being built in a sand environment in the United Arab Emirates required certain areas to be reviewed more closely than those areas would have been reviewed even in South Korea. So there are unique application specifics which would need to be created and brought to bear, depending upon actually where it is sited and what your regulatory regime is.

MR JACOBI: Mr Hoffman - - -

MR HOFFMAN: I am – yes.

MR JACOBI: Sorry, could I just interrupt? I am just interested to understand, could you explain what is meant by confirmatory analysis?

MR HOFFMAN: Each of the vendors' perform analysis of record themselves of the acceptability of what they are saying. Chapter 16 of – I'll come back. Chapter 15 contains the best of a safety analysis report contains the vast majority of safety analysis which show and confirm the capability, the facility to continue to operate in a safe manner given unique situation which may occur, such as a loss of off site power, a station blackout, loss of cooling accident, a steam generator tube rupture, et cetera. And so each of those analysis which are performed by the vendor, are performed by the vendor to demonstrate very unique technology has the following characteristics of compliance and also of being able to continue to operate safely, even in the event of this unexpected events and/or actions. In many cases, regulatory authorities do confirmatory analysis that confirmed that indeed the results are outcomes that are provided for by the vendor that their technology will conform or behave appropriately, will indeed do so under confirmatory analysis. The level of confirmatory analysis which is performed by the regulatory authority varies from regulatory authority to regulatory authority.

Now, I will tell you that because the US has such a great reliance on the national labs in this country to utilise to do the confirmatory analysis, those are matters of record. They can be brought to bear if something has been licenced and/or designed and certified in the US, but for other countries outside that, in many cases what we've seen is there has been partial confirmatory analyses, which have been utilised to justify and rationalise the acceptance of said analysis by the particular regulatory authority. So that's what I mean by that. And there's a variation on that theme and when you get into this, all those things can be shown to you.

MR JACOBI: Are you of the view that there are any issues, putting to one side a confirmatory analysis where you analyse work that has already been done, where a country simply has to do its own independent assessment of a particular topic, perhaps because of unique conditions for that country?

MR HOFFMAN: There have been a few. They've been minor. I have not been involved in any place where a confirmatory analysis performed by any regulatory authority was at significant odds with the analysis performed by the vendor. There have been some variations on the results and outcomes, but many of those have been based on the actual codes and things of that nature, with some variability which has been introduced.

The one thing, for example - and I'm sure John will speak to this - when we

were doing the technology selection in the United Arab Emirates there was a particular technology that was very much sought after by the ENEC group but could not be, despite confirmatory analysis, actually constructed in Barakah because of the fact that the location of the actual cooling water supply was insufficient to keep the condenser vacuum low enough at all times to assure they had a sufficient vacuum for continued operation where they would get the most efficient use of the turbines. So as a result, unfortunately that technology, despite analysis by the technology itself, by the technology vendor and confirmatory ones by the United Arab Emirates, ENEC did not get to a point where they could pick that one.

There are other variations on that where countries have done confirmatory analyses uniquely because of where they were. Analysis may be to the reaction when they did a seismic event because they were in a more high seismic zone, in particular where they were going to actually build or construct the facility that had initially been built during its licencing and/or design certification in the country of origin, and so there was an increased approach towards the actual scrutiny and rigour and, for that matter, the actual conservatism brought to bear in seismic, and so those kinds of things have led to some of the activities.

So those are the kinds of ones that we have seen, and when we've seen those we've actually recorded them to make sure that they are available for utilisation of any new nuclear build country. And as I was going to say, we're actually developing an approach which is generic for the World Nuclear Association CORDEL group that I serve on, where I've already started working myself. Seeing this in so many different ways, I'm trying to bring together a process which can be used by any regulatory authority, irrespective of how mature it may be, on approaching a technology that has a licencing and design basis in the country of origin so they can actually have a developed, robust and international nuclear community accepted approach towards its licencing in that country.

MR JACOBI: In the absence of there being such a regime, as I understand is the case at the presentation, I'm interested to understand the note that's contained at slide 44 that refers to the fact that, in your view, USNRC design certification might be able to minimise licencing effort over other regimes. I'm interested in whether you could perhaps explain that.

MR HOFFMAN: You broke during that last part of the question. You want me explain what, sir?

MR JACOBI: I'll ask the question again. In your notes at 44 you make reference to the fact that USNRC design certification might be able to minimise licencing efforts in another country as opposed to another regime.

I'm interested to understand whether you could expand upon that.

MR HOFFMAN: You're asking me why did I put the country of Vietnam at the end of that sentence?

MR JACOBI: No. I'm interested in understanding why you're expressing a view that the USNRC design certification might offer an advantage over other countries.

MR HOFFMAN: Simply because it's gone through, in most cases, a significantly greater and more robust rigorous review. I'm not saying that other countries don't have a robust regulatory authority approach to reviewing or licencing a design certification for their technologies in the particular countries of origin, but I do know specifically that the USNRC will have had a more robust and rigorous one than the vast majority of any of them. So, for example, what I've seen in Korea versus what I'm seeing in China versus what I'm seeing in Russia, or their technologies versus what I see for the technologies that have gone through this, and the USNRC, it is significantly more rigorous and more robust in the US than it is in Russia, China or South Korea for that matter. But I'm not saying it's not adequate. It's just not as rigorous.

So in almost all cases, there's significant rigour, and detailed reviews will lead the greater likelihood that it would cover any regulatory regime that may be considering that particular technology.

COMMISSIONER: Mr Hoffman, thank you very much for your very useful advice and for the preparation for today's meeting. We very much appreciate the time you've taken for that on both of our opportunities to talk to you on this important issue for us.

MR HOFFMAN: Thank you so much, and I appreciate the opportunity very much. Again, you have all those slides, and there is so much more to tell you than we were able to do in an hour, and I would welcome the opportunity to travel there to Australia, or to have another call with you, whenever you're ready, Mr Commissioner, about any more discussions about these activities.

COMMISSIONER: Thanks very much, Mr Hoffman. We'll now adjourn until 10.30 when Dr John Loy will be our witness.

MR HOFFMAN: And if you discover you have any follow-up or any information, please don't hesitate to let me know.

COMMISSIONER: Thanks very much.

ADJOURNED **[9.06 am]**