

RESUMED

[10.31 am]

5 COMMISSIONER: We will resume on the subject of regulatory oversight,
and I welcome Dr John Loy.

10 MR JACOBI: Dr John Loy was until late November 2015 the deputy director-
general of operations division at the Federal Authority for Nuclear Regulation,
FANR, in the United Arab Emirates. In this role he led the operations division
in preparing regulations, safety assessments, managing licensing program
inspection and enforcement and incorporating with and advising other
governmental agencies on relevant matters. He also managed the technical
capacity building and training of Emirates employed in the division.

15 Dr Loy joined FANR in December 2008. A physicist by training Dr Loy was
the founding CEO of the Australian Radiation Protection and Nuclear Safety
Agency, ARPANSA, for over 10 years, during which he licensed the
construction and operation of the OPAL research reactor. He has contributed
extensively to international work in radiation protection and nuclear safety, and
20 the Commission calls Dr John Loy.

25 COMMISSIONER: Dr Loy, the UAE is a fascinating case study for us
because it's a nation that progressed very quickly from what I would say
probably very little nuclear knowledge to an organisation that's established its
regulatory regime, it's well under way in terms of constructing four nuclear
plants, and so we want to tease our your experience in helping to develop that
organisation. So can I start with what was the basis of the national policy that
was established to support the regulatory regime of the nuclear industry itself.

30 DR LOY: In 2007 and 8 the UAE did a lot of study on the issues of whether
nuclear power was suitable for the UAE and they arrived at a conclusion that it
was because of the increasing electricity demand projected over the next
20 years, and the fact that supplies of gas were limited in the UAE, so it would
have to import natural gas if it went down that direction and, of course, other
35 questions like climate change and so on and so forth.

40 So it put all that together in a policy that gave the rationale for the nuclear
program, or gave the rationale for considering a nuclear program. The policy
always was framed in terms of evaluation of a nuclear program and the
evaluation was effectively a practical evaluation by having a tender process for
a contract.

45 COMMISSIONER: Can I just interrupt there, was there a national energy
policy that went with that, or was it a precursor to the evaluation?

DR LOY: There wasn't really a national energy policy as such, but there was certainly some - in fact, the UAE is a complex federation, let me put it that way, even more complex than the Australian federation in many ways, so there were energy policies of a kind in Abu Dhabi and Dubai and in the other emirates, but a national energy policy I don't think was evident.

The context then was to say, "Okay, this is why we want to consider and evaluate nuclear energy, and these are the criteria upon which we will base any decision to go into nuclear energy," and it set out these six principles of complete operational transparency, higher standards of safety and security, adherence to the IAEA standards and so on and so forth. So these were six principles that it set out in the policy for the evaluation of nuclear - that it would adhere to if it decided to go with nuclear energy. So they were very important principles that shaped the rest of the program for evermore. It was followed by the nuclear law in 2009 and interestingly the nuclear law kind of invokes the policy, so the policy is kind of translated back into the legal structure by being referred to in the nuclear law.

MR JACOBI: I just want to pick up with respect to the policy, what was the significance of the six rationales that you have identified in terms of the later decisions that were made in the UAE and the development of its program?

DR LOY: It started with complete operational transparency which talked about - which specifically focused on international transparency, the commitment to international agreements, there would be a national legal framework, there would be an independent regulatory body, and all of these were part of complete operational transparency, and then the commitment to higher standards and non-proliferation which included the commitment not to enrich or to reprocess domestically, higher standards of safety and security, close cooperation with the IAEA, partnerships with government and firms of responsible nations - which is an interesting way of putting it - and long-term sustainability in terms of developing an emirate capacity to sustain the nuclear program.

MR JACOBI: Have those principles been changed subsequently?

DR LOY: No.

MR JACOBI: What you have described are a series of fairly broad principles and I'm just interested to unpack perhaps first of all by reference to international commitments, what that then led to in terms of the international commitments that the UAE entered into.

DR LOY: It certainly had previously entered into safeguard agreements, but in terms of nuclear safety it entered into the Convention on Nuclear Safety and

the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management, the very long-titled convention, plus the conventions on notification and requesting of assistance and the CPPNM, the Convention on Physical Protection of Nuclear Material, it entered into the amended version of that. So these were important commitments on the UAE's part to take part in the international system and to have peer reviews of what was going on in the UAE.

The important part of those conventions, the Convention on Nuclear Safety and the Joint Convention, is the notion of peer review, that you do produce a national report and that your national report is then subject to review by other countries who can ask you questions, you respond to the questions, and then defend if you like your report before your country group at the review meetings.

COMMISSIONER: The commitment not to enrich, was that reflected in an international agreement as well?

DR LOY: It was certainly reflected in the bilateral agreement with the United States. It's reflected in the law, in the nuclear law that was passed. I don't think it's in any other international agreement as far as I'm aware.

COMMISSIONER: It's been put to us in previous evidence that this commitment is not binding and can be changed under certain circumstances in relation to what happens in the Middle East.

MR JACOBI: I think it's expressed in terms of more preferential treatment.

COMMISSIONER: Yes.

DR LOY: I'm not aware of any notion to change it in the UAE. I mean, UAE is a sovereign country and if it wanted to change it, it could. I think the evidence of Prof - sorry, his name suddenly escapes me.

MR JACOBI: Sokolski .

DR LOY: Sokolski, and then response by Prof Evans, Gareth Evans, was illuminating on this subject. Of course the UAE as a sovereign country could decide to change the policy, but they haven't done that and I see no reason why they should do it. It has gained them a lot of international credibility and a lot of international support from the US in particular. So they would be loath to change it.

MR JACOBI: We understood from evidence this morning that the UAE adopted and applied the Milestones, a document issued by the IAEA. I'm

interested to understand the extent to which that was followed, and then also to understand how that was adapted as it's been expressed to the conditions that were particular to the UAE.

5 DR LOY: Well, the Milestones document sort of assumed a process that would last more years than the UAE had to devote to this project. So we started out at about milestone 1 in any case, 1 and a half, and were very quickly at milestone 3, and there was INIR mission, an Integrated Nuclear
10 Infrastructure Review mission, from the IAEA early in 2011 which reviewed the UAE's response to the Milestones approach and found that we achieved most of the milestones required by that stage of the process. They made some recommendations, particularly about safeguards which we hadn't then fully committed to, but have subsequently to, and a couple of other minor things, but in general, they found that we followed the Milestones approach very well. It
15 was adapted in the sense that the Milestones drafters had a particular way of thinking in mind, which the UAE program was quite differently structured.

MR JACOBI: The reason I speak of the idea of adaption is that I understand that the Milestones, and indeed, having read them, are quite a general
20 document in terms of providing the framework for implementation, and it's been spoken of that one then needs to implement those milestones with national laws, taking into account national circumstances. I'm interested to pick up on that issue of adaption, I think what you might have described in terms of a tension between what the drafters had in mind and what it is that you
25 needed to do, and I'm interested to unpack what that might mean.

DR LOY: Yes. Well, I mean, I think you take the notion of the Milestones and you accept that you should reach certain stages by the time you call for a tender, and you must have done other things by the time you let a contract, and
30 you just adapt that to what you need to do. You have to have regulations in place, so you get the regulations done. Now, a Milestones approach assumed this would take several years. We were able to do it much quicker than that, but nonetheless, we were still following the Milestones approach of having them in place by the time you reached certain stages of the program.

35 MR JACOBI: There are a number of international advisory groups aboard in a group, and I'm interested to understand what their role is in the structure, both of the regulator and of the operator, in the UAE and the effect that they've had in terms of building credibility with respect to the program.

40 DR LOY: Well, first is the International Advisory Board, which is an advisory board to the UAE government as a whole and it consists of very eminent people led by Hans Blix and people of a similar reputation and quality, and it meets once every six months and we all appear before it, "we all" being
45 FANR, ENEC, the Emirates Nuclear Energy Corporation, and others may

appear before them and are questioned and we make presentations and they issue a report which is publicly available. It's on their website and it gives a great deal of strength to the program. I think you can find things in those reports that you wouldn't find about most nuclear programs.

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I recall in the meeting before last there was a quite a vigorous discussion on severe accident analysis in which our nuclear safety leader responded to some rather probing questions on our severe accident analysis, and they were taken up with ENEC as well, and it was quite a detailed discussion of those points, as well as more high level issues. So it's quite a process and it gives a lot of credibility to the program, I think, to have that high level view.

Then further down, if you like, in the detailed nuclear safety regulation, you have an international advisory group, which has just been reformed because the first group remit ran out, and it's been reformed and it's particularly useful to give a kind of expert advisory group on nuclear regulation so that it consists largely of regulators from other countries who can cast their eye and ask where the bodies are buried and who know from their own experience where they're likely to be buried and can give us some advice about how to deal with issues. The plan was - I keep saying "we". Sorry. I'm quite used to the - - -

COMMISSIONER: We understand "we".

DR LOY: Okay. The plan for the next stage of the international advisory group is to focus on how FANR is going to reorganise itself to deal with reactors in operation. We've been dealing with solely construction up until now. We expect that the first reactors will go into operation in 2017 and we need to have some changes to the organisation to manage that process. In the longer term, they'll all be in operation, one presumes. We'll be solely regulating operation, so we need a transition plan to do that. The international advisory group will be tasked with helping us do that.

MR JACOBI: Are you of the view that the international groups that you've just referred to have had a particular effect on the conduct of ENEC, the developer of the projects, in terms of their behaviour or conduct that's been desirable?

DR LOY: Well, I think it certainly means that you're under scrutiny, and I also emphasise the peer review processes under the IAEA as being important to give us international scrutiny. The IRRS, the Integrated Regulatory Review Service, mission that we had at the end of 2011, and subsequently a follow-up mission at the beginning of 2015, was a very important review of our overall regulatory structure and arrangements. Subsequently we had an EPREV, an Emergency Preparedness Review, mission and we're preparing for IPPAS, which is the International Physical Protection assessment, mission, and all of

these meant we're under significant international scrutiny with the International Advisory Board, the IAG/NSR.

5 ENEC has its own international advisory structures, and the IAEA structures meant we're under considerable scrutiny, which means you behave in a way that means you will survive such scrutiny, is the simplest way I've got for putting it.

10 MR JACOBI: You spoke of a national nuclear law, I think, of about 2009, and I'm interested to understand, the UAE had essentially, as I understood it, a blank slate as it existed before that time, and in terms of how it went about thinking about the type of approach it wanted to adopt, we've heard about outcomes-based approaches or prescriptive approaches, and I'm interested to understand, given the sorts of models that were available, how the UAE
15 thought about the idea of what kind of law that it wanted to implement.

DR LOY: The law went through a lot of drafting stages, as you can imagine. It had considerable assistance from the IAEA. It was also circulated to other countries, which is an unusual step to make, circulated to France and the
20 United States amongst other countries.

COMMISSIONER: To their regulators?

25 DR LOY: To their regulators and to the governments, in effect, and the drafters received comments and there were processes going on. My direct experience of the drafting of the law tended to be a black box. It would come into FANR - or FANR before it existed - as a draft. We would make some comments on it and send it out again to the drafters and it would reappear later. Some of the issues included the dreadful subject of definitions, which is always
30 a great bane in any law. Largely, we relied upon IAEA's safety loss re-definitions for that. So that was a commitment to the IAEA approaches right from the start.

35 The other issue of significance at that time was whether the existing regulation of radiation activity in the UAE would continue under the old regime or would be absorbed into the new regime. That was a quite late decision-making process. But I think the basic structure of the authority is one that is pretty familiar in terms of the UAE, to have a board of management, as it's called, composed of UAE citizens and then an organisation of the CEO or Director
40 General in this case who answer to the board. One of the important things to get right and any such law is to be clear about who is the decision maker and it is clear in this case that the board of management is the decision maker for nuclear licensing in FANR. That is fairly straightforward in a sense when you are dealing with one licensee of a nuclear power plant programme. When you
45 are dealing with thousands of licensees and the radiation, it becomes a little bit

of a burden but you can find ways around that and we have. I think I am rambling at this point.

5 MR JACOBI: Can I pick up here; I am just interested to understand how far the UAE went in terms of the development of its regulatory structure in that first step. That is that it passed nuclear law in 2009, at that point there was no need for example safety regulations that manage the operation of a reactor. How far did it go in that first tranche and then how did it proceed to go down the track of iteratively developing its regulatory regime?

10 DR LOY: Well, it was a little bit of simultaneity rather than iteration while the law was being developed, FANR was also – well, pre FANR was also thinking of its own regulatory style and approach. We knew we were committed to the IAEA through the principle in the policy, so we adopted the IAEA safety
15 standards as being the likely high-level regulations that we would adopt. We made that clear and that was a decision taken quite early in the piece, if you like by the staff of the ultimate regulator and in some presentations to potential vendors during the tender process, we outlined this approach that this would be high-level regulation based on IAEA safety standards. And other regulatory
20 guides would be taken up in more detail depending – partly depending upon the vendor country, which we will no doubt go in to in more detail later. But we had, from the time early in 2009 through to the end of 2009, we were developing regulations based upon IAEA safety standards. Had the first drafts out in early 2010 and they were finally made formally by the end of 2010. So
25 they were the siting and management system and design regulations which were the most important for the first stage in the nuclear programme.

MR JACOBI: Was there – we understand there is a choice between models, what has been described as an entirely outcomes based approach, the UK
30 model, what is more prescriptive approach, the US model and then a middle ground that has been described in terms of having a regime that is prepared to pick up regimes that might apply elsewhere. I am just interested to understand where the regulatory regime was that was ultimately developed in the UAE was on that spectrum and the reason for picking such an approach?

35 DR LOY: Well, I think we were at the stage of saying we wouldn't rely solely on outcomes, we wouldn't go down solely the UK path but we would high-level regulations based on IAEA safety standards and then regulatory guides which would say this – if you follow these regulatory – if you follow
40 this process you will get through. You will get a tick. If you want to do it some other way, you can but you have to demonstrate an equivalent level of safety meeting the requirements. So that gave a bit of freedom to the operator to devise different ways of doing things while at the same time making sure that he had some reasonable degree of rigour in the regulatory process.

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MR JACOBI: Was that approach modelled on any particular country in the way that it had developed its regulations?

5 DR LOY: Not really, they tend to be a little bit coupled together from our own experiences. Our own experiences, I am talking to the senior people in FANR who all had a lot of nuclear regulatory experience, so we were forming together by discussing and talking amongst each other what was the best way I approached it, we thought would work in this context. And this was the approach that we adopted. I think it is a little bit different from almost
10 everyone else.

MR JACOBI: With respect to the regulator itself, FANR and the use of an international advisory groups and that particular structure, again was that a structure that was modelled on any particular regime that had been and
15 developed anywhere else in the world?

DR LOY: The notion of having an international advisory group to the regulator is perhaps not unknown but it's unusual. International advisory board I think is unique as a structure (indistinct) to have. So we are pretty unique
20 ideas I think by and large.

MR JACOBI: You spoke of the idea of there being a pre-FANR and then FANR was established. We are interested in understanding how the UAE went about the idea of building regulatory competence? First of all, that is gaining
25 some initial regulatory experience in order to develop the sort of regulations that you are talking about.

DR LOY: Well, by first of all recruiting a small number of people with significant nuclear regulatory experience and then having them sit down, work
30 together about the regulatory approach, as I have described and then sit in interview rooms for a long time. The first year I sat in an interview room, interviewing people from wherever, all over the world and trying to recruit people who had real technical experience and I was talking about the nuclear regulatory experience being kind of regulatory decision making, then we need
35 of course technical expertise, people who know about pipes and valves and electrical work and thermal hydraulics and all that kind of stuff. And it's a matter of getting a (indistinct) of them available and we found a lot of interest in the programme. We didn't have any trouble getting people to interview but took a long time get many people on board of course because of having to
40 move countries and the like but we were really very lucky in being able to have the pick of the world in many respects, of people who, for whatever reason, were willing to move to the UAE. A number of people from the agency who had worked in the agency because they came from a country, worked in the agency, so they moved once, they were willing to move again, if you like. But
45 other people who were returning to the Middle East because it was their

original home, other people who just wanted to work in a real nuclear programme. I think that was the main attraction that this was a real fair dinkum nuclear programme, new nuclear build programme. There weren't many going in the world.

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COMMISSIONER: What about local interest as you went to build up this organisation? That is - clearly the sustainability of an organisation is clearly important, how did you plan for that?

10 DR LOY: Absolutely. First of all there was some national planning that went on and scholarships were offered for people to undertake bachelors or masters programmes in nuclear engineering and related engineering.

COMMISSIONER: This would have been overseas I take it?

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DR LOY: Yes. Yes. There is one university that has been established with a Master of Nuclear Engineering programme in the UAE but most of them have gone overseas of course, yes. So they were funded to go overseas and study for a bachelors or masters programme in nuclear engineering or civil engineering with a nuclear background, whatever it might be. So that was a national programme in which people were then funnelled – had the choice whether to work in ENEC or FANR. ENEC is the larger consumer but a number of those graduates have come to FANR as well. In addition, we just simply went out and found other people who were interested and who just knew graduates in engineering or in medical physics in some instances, the radiation safety side and recruited them. Then started training them from scratch as it were. It is fair to say there's a lot of pride in the UAE and the nuclear programme, it's regarded as a national effort, well worth – something that a young person is proud to enter. So it was again, not difficult to find people willing to put their hand up saying we'd like to join you.

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COMMISSIONER: Proud because of the new technology?

DR LOY: Yes. And I think because of the fact that UAE was the first country in the region, in the Arab world to have a nuclear programme, the fact that it was supported by the United States in the way it was, made them feel good.

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COMMISSIONER: Can I just finalise one question? The interchange between ENEC and FANR, we've heard from other sources that people are very wary of transferring from one organisation to the other. Is that something that you considered important to look at or - - -

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DR LOY: Well, the relationship started out to be very intimate, in fact, because the Executive Affairs Authority of Abu Dhabi was charged with setting up the nuclear program. So they set it up in one building and ENEC

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was down one end and FANR was down the other. The proto-ENEC was down one end and the proto-FANR was down the other, and subsequently then, of course, the paths diverged and we got our own buildings and the like. I think it was seen as important to make clear that they are separate organisations and there is a potential conflict of interest between the regulator and the operator. There have been a couple of cases where people have been recruited by one organisation from the other, but that's very rare and sort of not encouraged. They were pretty unique cases in each case, and we'd prefer to run our own race.

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MR JACOBI: I just want to pick up that issue of independence as well, in terms of the regulator; that is, to what extent is FANR independent of the government?

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DR LOY: Well, if you read the law, it's very independent. The decision making is done by the FANR board. Nobody can undertake a nuclear activity without a licence from FANR, and the licencing is exclusive to FANR and it's made a decision by the board of management of FANR, nobody else. No one else need be consulted or asked or anything. So in that sense, it is very independent. Like every regulator, it's part of the government, like STUK in Finland is part of the government.

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There's a question of budget. There's a budget stoush each year about how much budget we should have and we fight with the Department of Finance like every department in the world does. So we're not fully independent in that sense. We can't just make up, say, we're going to spend \$400 million this year and everyone has to salute. We go through a rigorous process of justifying that amount. So I think it's independent in the right ways and part of the government in other ways.

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MR JACOBI: In terms of FANR's funding, I understand that with respect to a number of regulators, the funding is drawn from licence fees that are paid or fees that are paid for assessing applications. What's the position with FANR?

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DR LOY: With FANR there was a resolution passed by the cabinet. As I said, 90% of FANR's approved budget will be paid by ENEC licence fees, by the licence fees for nuclear regulation and for nuclear facilities. There are also licence fees charged for other licensees for the small radiation users, but they are very small. So effectively, 90% comes from ENEC as a licence fee and 10% comes directly from the government.

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MR JACOBI: Just a final aspect. In terms of the regulations, and I think you referred to the regulatory guides, with respect to the authority as to what they contain, who has authority with respect to their content and the requirements that they impose?

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DR LOY: The regulatory guides are made the director general of FANR. They're not actually made by the board, unusually, because the board makes the regulations and then these are filling out the regulations. Our regulatory
5 guide in this area is the USNRC's regulatory guide on the subject. We don't necessarily rewrite everything or create new regulatory guides where we think there are existing ones that are useful and do the job. Other regulatory guides are more structured to meet our own different requirements, but it need not be written down for product. It can be an adaptation of somebody else's.

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MR JACOBI: These are the guides that describe the method acceptable, don't they, in terms of achieving the outcome?

DR LOY: Mm.

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MR JACOBI: You spoke of the board being able to make the regulations. Do they separately need to be made by the government, or is there any government involvement in the making of a regulation?

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DR LOY: No. The regulations applying to the nuclear sector are made by the board of FANR and we go through a process of drafting a regulation, which is then sent to government stakeholders for comment, and we receive their comments and take them into account. There then is a second process of releasing them for public comment, and we take those into account. Then
25 they're put to the board and adopted and published in the official gazette. One of the questions there is the translation into Arabic of course. That can be a challenging issue. It challenged us quite significantly at the beginning. We became better at it as we went along.

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COMMISSIONER: Could you just outline for us the class of board member that has been selected, in your case, for the FANR board?

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DR LOY: Well, they are eminent people: for example, the director general of the Abu Dhabi National Oil Company who's the chairman of the board; and the
35 people from Dubai and from elsewhere who have some technical background and legal background, by and large, but have no claim to be nuclear experts at all.

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COMMISSIONER: Okay, and the number on that board?

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DR LOY: Seven.

COMMISSIONER: Seven.

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DR LOY: Yes.

COMMISSIONER: So business, legal expertise predominance.

DR LOY: Yes.

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MR JACOBI: In terms of the making of the regulations, at least to Australian lawyer who looked at the process of regulations as they were made, they're drafted, they're gazetted and then they're subject to potential disallowance. Is the process different, in terms of the UAE process, for these particular kinds of regulations?

DR LOY: Yes. The regulations, as I said, are simply made by FANR. Once they're adopted by the board and there's a full resolution published, they're then published in the official gazette and become part of the law of the land. That's an unusual process from an Australian perspective, and I don't think it could apply in Australia. So if you wanted to follow the same approach, you'd have to think of some other way of doing it.

MR JACOBI: I understand there's a separate process within the law for construction licences and operating licences, and I'm interested to pick up the idea of the review of designs. It's something that we picked up in evidence this morning, and I'm interested to understand what, in practical terms, is done within the UAE in reviewing designs where those designs have been licenced in other jurisdictions.

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DR LOY: Well, the construction licence application consists of a preliminary safety analysis report which describes the design of the reactor and subjects itself to a safety analysis. So the review is of that submission. We took the approach of dividing the preliminary safety analysis report into chunks; work packages, they were called, for whatever reason, work packages A to G. So each chunk consisted of where we went out for a contract with a TSO, a technical support organisation, a technical consultant, to assist in the review of each chunk, and the review consists of basically a standard - against a standard review plan, which followed the USNRC approach, but taking the UAE requirements and describing the submission made by ENEC and the preliminary safety analysis report made by them.

We would go back in each case and have requests for additional information where our reviewers couldn't understand something or felt it was wrong or wanted further justification. They would go back with a request for additional information and ENEC would respond to that, and that process generally reached satisfaction between the reviewer and the ENEC submitter. I say "generally", because a construction licence stage can be a little bit - you don't have to settle everything completely. We made that decision that we wouldn't necessarily try and settle every aspect of everything before issuing a

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construction licence but there were a number of areas where ENEC said it had further work to do and we agreed it had further work to do. We were sufficiently confident in the outcome or at least an alternative to what ENEC was proposing would satisfy us, that we could go ahead with issuing the construction licence on that basis. So we would call it conditional acceptances. So we accepted the PSAR in this area on condition that ENEC did further work and ultimately satisfied us in that area. So it was quite a lengthy and labyrinthine process to get all of those things together. We used the – in some instances, in some chunks of the – some sub-chunks of the work packages, we said we will largely rely upon the work done by KENS, the Korean Institute for Nuclear Safety and their assessment of the PSAR for Shin Kori 3 and 4, which is the reference plant for the Barakah units 1 and 2.

Now what “rely upon” meant it’s really hard to describe quite what it means. It means you obviously read the Korean SER, the safety evaluation report which was provided in translation in to English by the Koreans. If you don’t understand it, or have some questions to the Korean regulator, we had a process for asking questions of the Korean regulator about what it meant in its SER but then really not trying to do much original work in a review of that part of the PSAR. So the reactor core remains exactly the same as in Shin Kori 3, so why would we necessarily do all the original work again. As long as we read the SER from KENS we were satisfied with it, it made sense, it looked appropriate and they responded to questions when we had them then that would be enough to satisfy ourselves that the FANR regulations were met. The decision-making was clear that we were satisfying ourselves that the FANR regulations were met. We weren’t just simply accepting the Korean evaluation; we were relying upon it as a good indicator, if you like.

MR JACOBI: What underpinned the decision to decide that you were prepared to proceed on an approach where you relied – and I mean that in the sense that you explained it, relied on the approach that had been taken by the Koreans and which areas guided your decision, you thought well this is going to require a thorough and complete independent verification?

DR LOY: Well, the latter part of the question is straightforward in many respects. Clearly, where there were differences between the Korean design and the Barakah design, we had to do our own ab initio review. Now that obviously relates to siting the – obviously the UAE site is quite different to the Shin Kori site and even some seemingly trivial issues like the fact that the cycle of electricity is different in the UAE to what it is in Korea. So that means some design changes to take that in to account. So that had to be examined ab initio as well. And some areas were thought so important that you wanted to do a full review yourself like the severe accident analysis was one particular area.

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MR JACOBI: Having been through this process, do you have any observations for perhaps if you had to come at it again, how you would make the most out of any international regulatory decision making that had gone on in advance?

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DR LOY: Yes, it is an interesting challenge. It is – the nuclear industry is not like the aircraft industry, just buy a Boeing 747 in the nuclear industry and there may be some good reasons for that and there may be some bad reasons for it but it is different. But the use of other people's evaluations is increasing. We participate in the MDEP programme, the multilateral design evaluation programme which is evaluation programme which is supported by the OECD Nuclear Energy Agency but they let us in by the side door. So say the OECD NEA is a club but it's not an exclusive club. So we participate in the MDEP processes. In particular there is a working group on the APR 1400 reactor as it has gone for design certification in the United States and it also of some interest to Finland. So the Fin's, ourselves and the US and the Koreans participate in a working group to look at the APR 1400 design as it evolved. So we use – we are giving some experience there and also receiving some experience from the US evaluation in their design certification evaluation.

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MR JACOBI: What is the ultimate goal of the MDEP process? Is it so that there is a – what I might – for want of a better word a preliminary international agreement that a particular design meets a particular standard, or is it – so sort of a pre-licensing step or what is the end goal of that sort of analysis?

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DR LOY: I think you would have to say that it started out with perhaps a greater ambition to be a multilateral design evaluation programme, to take those words literally and it still found it difficult to achieve that. Then you can find all sorts of differences between countries and they may matter and they may not matter. Even the minor issue of the codes for building a vessel need to withstand certain pressures, do you use ASMI codes or do you use some other form or code? A national code, or – so these things are just – differ from country to country. Whether they are important or not, the MDEP may be able to shine some light upon, and say well these areas, doesn't matter really what code you use, as long as it's a legitimate code. Other areas it is important that there be consistency of approach.

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COMMISSIONER: While we are talking about parts, what was the FANR responsibility for parts in the supply chain? Did you rely on ENEC to provide assurance to you that the Korean supply chain was satisfactory and produced the parts in accordance with the plan?

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DR LOY: Well, the short answer is yes. The long answer goes to the fact that we did a lot of work on the management system of ENEC. We were very insistent upon there being a management system which involves quality

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assurance but is wider than that. And so a lot of our early inspections are about the quality assurance arrangements and the management system arrangements undertaken by ENEC to manage the whole project.

5 COMMISSIONER: Right.

DR LOY: Including the supply chain. The issue of counterfeit parts in Korea surfaced. We obviously asked ENEC what they were doing about it. And it was a fair shock to them, must be acknowledged. And so they described some actions they were having of reviewing their supply chain suppliers and getting them to make commitments and doing practical things like actually testing some materials independently.

15 COMMISSIONER: Right.

DR LOY: And we reviewed that and we got some advice from experts from the United States about whether that measured up and we made some comments to ENEC which they improved their programme, CFSI examination. We were also undertaking some independent inspections down the supply chain in Korea, just take for example a diesel generator which very important piece of safety equipment, supply chain comes from everywhere for such a device, such a piece of material. So just to follow through the diesel generators and find the supply chain for those and do some inspections, independent inspections. And that is really to put the fear of God in to the system more than expecting that you necessarily will find anything. But it was certainly something that was important for us to make sure that ENEC was across and managing as well as it could. As far as we know, there are no – there haven't been any – there certainly haven't been any CFSI suspect parts found in the Barakah supply chain. I'm not saying there won't be, but there haven't been.

30 COMMISSIONER: I was just interested in the process of how you assured yourself that ENEC had taken satisfactory steps to - - -

35 DR LOY: Yes.

COMMISSIONER: - - - assure themselves that the supply chain was appropriate.

40 DR LOY: Yes. Well, as I said, that was a very important part of our process right from the start and of course redoubled with the scandals.

COMMISSIONER: Thank you.

45 MR JACOBI: I just want to come back to another aspect of regulatory design, and that is, I think what I described (indistinct) as iterative before. I understand

that a number of regulations were written at a point in time when the Korean suppliers had already been selected as the preferred supplier for the reactors, and I'm interested to understand the extent to which it assisted in a regulatory structure to in fact know that what you were essentially going to be dealing
5 with was an application to construct and operate four particular Korean-built nuclear reactors as opposed to having to create a regulatory structure that had to cope with a potential range of private sector vendors that might be interested in constructing.

10 DR LOY: Yes. I think at the level of the regulations, we probably made them sufficiently general to allow for a number of vendors, but at the level of regulatory guides, yes, it was important to know that it was a Korean plant, and the origin of the design went back to a United States design some years ago. So its origin was in the US and the Korean regulator tends to follow USNRC
15 practice. So that guided us to say USNRC regulations or regulatory guides would be the most apposite. And that was important. Had it been the EPR, then we would've tried to ape the French, which couldn't be more difficult.

MR JACOBI: So the concept is that the regulatory structure that might've
20 been established might've had a regime that, instead of being the US, as I understand, prescriptive regime, it might've had a more French approach in terms of the way that the safety requirements were specified.

DR LOY: Well, safety requirements would be the same. It's a matter of how
25 you go further down in the technical detail, and I think the regulator needs to talk the same language as the operator in this regard, particularly as the operator is responsible for safety. So you need to know how they approach their thinking, and if it's a USNRC approach or a French approach it would be a little bit different. I don't think it would be fundamentally different. One
30 hopes that it will be fundamentally the same, but there will be certainly different styles of thinking and approach to demonstrating safety.

MR JACOBI: You refer to technical support organisations, and I'm interested
35 to understand the significance that technical support organisations play, in particular in a newcomer regulator in providing it with the ability to be able to undertake the sort of safety assessments you talked about.

DR LOY: Yes. Well, they were very important and we certainly had a major
40 contracting process which ultimately led to award of contracts to three consortia based in Europe and the US, and some of the US consortia are also used, participants from Europe. So that was a major contracting exercise and it was very important to give us the grunt to do the detailed review of the PSAR. This PSAR comes in 2,000, 8,000, 10,000 pages of detailed analysis and
45 description. Just to have the grunt to go through all of that and to detect issues and to raise requests for additional information meant we had to rely upon the

assistance of technical support organisations. I think we always will. I think any regulator always will.

5 I don't think you can create in one organisation all the technical requirements that you need to cover a full nuclear power plant. It would just be inefficient because you mightn't need a thermal hydraulic expert all the time; we might need them from time to time. So it's better to have them on tap rather than in-house. Certainly in terms of just having the numbers onboard to do the construction licence application assessment, they were very important.

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MR JACOBI: Was there a particular peaking in the workload in terms of doing the assessments and that then dropped away and then there was a second wave of work?

15 DR LOY: See, the construction licence application came in in December 2010 and that was a major piece of work begun, and Fukushima occurred in March 2011, which required another review analysis of the design against Fukushima lessons learned, which we asked ENEC to do against a European stress test kind of methodology. So that was a major piece of work which
20 culminated in the award of the construction licence in July 2012. But there was still a considerable body of work following from the construction licence application.

25 You couldn't rest on your oars at that point, because, as I said, we had a number of commitments made to still achieve open issues in the construction licence, and so there were further submissions from ENEC on areas there. Plus, the Fukushima design changes that had been agreed were agreed in principle of course, and then the detailed design came in and we reviewed them as well. Then there came the construction licence application for units 3 and 4.
30 So all of this meant a fairly high workload continuously until the end of 2014 and we could rest on our oars briefly and the operating licence application came in for Barakah units 1 and 2. So it started again.

35 MR JACOBI: I don't think these are issues specific to FANR, but I'm interested to understand how the UAE approached them. First is the issue of how it's managed in terms of spent fuel disposal. What is the UAE policy with respect to that?

40 DR LOY: Well, there isn't an official policy approved by the cabinet. The law says there shall be an official policy approved by the cabinet. It hasn't happened as yet, however, I think the outlines are clear, and have been made clear by Ambassador Alkaabi at the join convention meeting at the last review meeting, that basically the UAE will adopt a baseline strategy of direct disposal of spent fuel in the UAE. So they'll start out pursuing that strategy but not
45 actually commit to the construction of any facility until it's absolutely needed,

which might be 50 years down the track of course, and in the meantime, also pursue other options that may arise in international regimes, regional regimes, people taking back spent fuel for whatever reason. So it has a baseline strategy of direct disposal of spent fuel in the UAE with that being pursued, at the same time leaving the options open for a little bit.

MR JACOBI: And the only other thing I wanted to pick up was decommissioning. In terms of the funding of decommissioning, I understand there's a trust fund that's just been established in the UAE to address decommissioning of plants. I'm interested to understand how that's funded and costed.

DR LOY: Well, yes. The law requires that anybody with a licence to operate a nuclear facility shall pay money into a decommissioning trust fund to cover the costs of the decommissioning of the facility and radioactive waste management, or spent fuel management really. So FANR is charged with recommending to the cabinet the creation of this fund, and when I left we were still in the stages of preparing a cabinet resolution to put to the cabinet on the fund. You would actually create two funds under the one umbrella, one would be for decommissioning; one would be for radioactive waste management, because the patterns of spending are a little bit different, and basically you need advice about what would be the sum of the money that would be paid each year and you keep that under review. And then you have an organisation to manage the funds in terms of investment and so forth. They have an investment strategy which would also be reviewed from time to time.

COMMISSIONER: So are the funds linked to energy production?

DR LOY: Well, ultimately the money has to come from somewhere, I think we were tending towards saying there will be a fixed sum of money each year that ENEC would have to pay. It wouldn't necessarily be related to their energy production, but ultimately it could be related to assuming factors and so forth. But, yes, there is still a fair amount of detailed work to do on all that.

COMMISSIONER: We might finish up with just one general question. As we contemplate the sort of regulatory regime that we might need were we to go forward with any part of the nuclear cycle, from your experience in ARPANSA, is there anything that we haven't covered this morning that you think would be pertinent to the high level formation of such a group in Australia?

DR LOY: Well, yes, there is the issue of security and the safety-security interface, and I strongly believe it's important that the regulator be a safety and security regulator because of those interface issues. Security can get in the way of safety and vice versa. The issue of safeguards is separable. There's less

potential conflict, though they need to talk to each other, the regulators there. So I think it would be important to bring security under the one umbrella, possibly safeguards as well, but I wouldn't insist upon that if I ran the world.

- 5 Identifying who is the decision maker is important and getting the regulatory approach right, and particularly it would be complicated in Australia by that need to have regulations made through the executive and being able to be disallowed by the parliament, the classic regulation with a capital R, and then the technical small r regulations that might be able to be made directly by the
10 regulator. Get the balance right between those two. They would be important issues. I can't think of anything else at the moment that I want to emphasise.

15 COMMISSIONER: All right. Dr Loy, thank you very much for joining us this morning, and thank you very much for the evidence you provided. We'll now adjourn until 1200, when we'll have Dr John Carlson.

ADJOURNED

[11.32 am]