HOUSE OF COMMONS

Energy and Climate Change Committee

Oral evidence: Small Nuclear Power, HC 347 Tuesday 22 July 2014

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Written evidence from witnesses:

- Office for Nuclear Regulation

Watch the meeting

Members present: Mr Tim Yeo (Chair); Christopher Pincher; John Robertson; Sir Robert Smith; Graham Stringer; Dr Alan Whitehead

Questions 180-225

Witnesses: **John Jenkins**, Chief Executive Officer, Office for Nuclear Regulation, **Dr Andy Hall**, Chief Nuclear Inspector, Office for Nuclear Regulation, and **Dr Adrian Simper**, Director, Strategy and Technology, Nuclear Decommissioning Authority, gave evidence.

Examination of Witnesses

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Q180 Chair: Good morning. Welcome to the Committee. Thank you very much for coming in. As you know, we have been taking evidence on this subject for a little while. Could I ask you to introduce yourselves briefly for the purposes of the recording?

John Jenkins: Yes, certainly. I am John Jenkins. I am the Chief Executive Officer of the Office for Nuclear Regulation.

Dr Hall: Good morning. I am Andy Hall. I am the Chief Nuclear Inspector in the Office for Nuclear Regulation.

Dr Simper: I am Adrian Simper. I am the Strategy and Technology Director for the Nuclear Decommissioning Authority.

Q181 Chair: Thank you very much. Could I ask Mr Jenkins and Dr Hall perhaps, in particular, what you think the main challenges are in relation to regulatory assessment of small-scale reactors, including small modular reactors?

Dr Hall: Yes. I think the challenges will be similar to those we are experiencing through the generic design assessment process for much larger reactors at the moment. That is that there will be new technologies proposed for the UK, some of which will be quite different from those that have been used in the past and we will need to get an understanding of those. It means also that the industry will have to demonstrate that it understands those designs, the hazards associated with them, and how those hazards could be managed. Fundamentally, we would expect, if we were asked by DECC to perform a generic design assessment on a small modular reactor, to go through a similar process to that that we undergo with the reactors at present.

Q182 Chair: Is there, in practice, any significant difference compared with what the process is for large reactors?

Dr Hall: There would not be a significant difference except in the case that the designs were citing novel means of achieving safety. For example, if they were using a high degree of passive safety or if they were making claims of inherent or intrinsic safety, we would have to examine those claims very closely. Of course, with small modular reactors there is the potential for more exotic designs, you might say: liquid metal-cooled designs, lead-cooled designs and so forth, as well as water and gas-cooled designs. We and the industry would have to develop our understanding of those.

Q183 Chair: Your written submission said that taking a small reactor of novel design through the GDA process would take about four years, and that was dependent on resource availability, and possibly an additional two more years or even longer to review a site-specific licence application. That sounds quite a long time, doesn't it?

Dr Hall: Well, that is because we have to do a very rigorous assessment of the designs that are being put to us and see whether the claims that the requesting parties make can be substantiated. In order to properly implement the standards that have been set by Parliament, we have to undertake that independent, robust assessment and it takes time. The length of time will depend on the quality of the safety submissions that the requesting parties make to us and whether they make those submissions on time.

Q184 Chair: I do not want to sound as though I am suggesting you should cut any corners because I think it is a terrific benefit to Britain that our regulatory system is a gold standard for the whole world. That is a huge advantage for us both in terms of safety and the confidence it gives to the public, but I think in the long term it is a commercial advantage as well. I am a great admirer of the reputation and thoroughness of the work that is done. Is there any chance that it would be quicker if a small reactor was a smaller version of an existing established type?

Dr Hall: It would certainly be the case that, if a smaller reactor was, as you say, a scaled-down version of an existing reactor type and one that we had already previously assessed, that would

make the assessment process easier because many of the issues surrounding it would have already been examined when we examined the larger design. In general, it is usually easier to assure, for example, cooling and some of the critical safety functions on a smaller reactor than it is on a larger reactor.

Q185 Chair: Do you look at the regulatory process in other countries to see whether ours can be either benchmarked or even streamlined in some way from the lessons you learn elsewhere?

Dr Hall: Yes. We work very closely with regulators in other countries and, as an example of that, with the EPR design we reached a common view with the French and the Finnish nuclear regulators on certain control and instrumentation issues. We came to a common position and jointly set out our views to the requesting party. We also worked very closely with the US Nuclear Regulatory Commission. In fact, for example, if we go back some years, we had one of our inspectors seconded to the USNRC for six months while they were undertaking a review of the AP600 design, which is a smaller version of the AP1000. We work very closely with other regulators, including through the Nuclear Energy Agency's Multinational Design Evaluation Programme, where we share knowledge and experience of regulating designs and where we are currently trying to come to common positions on various safety issues.

Q186 Chair: Is this a reciprocal process? Are they coming here to try to learn how you do it as well?

Dr Hall: Yes. In fact, we have had information exchange agreements with many nuclear regulators abroad for some years and those with the French have been particularly strong. Since the early 1990s, we have regularly had their nuclear inspectors seconded into our organisation, in some cases remaining with us for up to four years before they have returned to France. We have seconded regulators to them as well, so we share that experience.

Q187 Chair: Do these contacts extend to China and Russia?

Dr Hall: Not at present, no. There are questions about the setting up of information exchange agreements with those two countries and I know they are progressing with China, but we do not have that relationship yet.

Q188 Chair: Are there any reasons why you would wish to treat them differently from the other countries with whose regulatory bodies you do have contact?

Dr Hall: There are a number of aspects to this. We have information exchange agreements with western-type countries that have similar regulatory processes to ourselves, albeit many of them are rule-based rather than goal-setting. We would have to gain a greater understanding of the Chinese regulatory system to engage with it as well as we could. We also have to bear in mind security issues, and that applies to all the countries that we have information exchange agreements with.

Q189 Sir Robert Smith: On the international side, how does the Multinational Design Evaluation Programme work?

Dr Hall: This is a group of nuclear regulators from a number of countries that are in the NEA and they share information on the technical assessments and the technical issues that arise from, in our case, generic design assessments and in other countries it might be design certification with the States or the other regulatory processes. We share information on the technical regulatory issues that are arising and it is a means of sharing that information to see whether other regulators see the issues from the same perspective as ourselves. If they do not or if, perhaps, they have already examined the issue themselves and consider it has been resolved, we can have that discussion with them about why that is the case, but it means that we all gain the benefit of many different people looking at the same issue.

Q190 Sir Robert Smith: Does it speed things up because someone has been through an assessment?

Dr Hall: Yes. If we can learn from what others have done, we wish to do that. In fact, in terms of the length of the GDA process for small modular reactors, whether it is a small modular reactor or whether it is one of the larger reactors that we are currently assessing, we want our process to be as efficient as possible and sharing information with other regulators, standing on the shoulders of others, is a way of doing that.

Q191 Sir Robert Smith: I suppose if the small modular reactors were to take off, the idea would be economies of scale with a larger market and, therefore, agreeing a regulatory scheme with another market might open up potentials for savings.

Dr Hall: I think it would be very difficult for regulators in different countries, bearing in mind the different legal systems, simply to issue a joint statement of the acceptability of a reactor design. In the USA, for example, the design would have to meet the rules that the regulators have issued there. In the UK, we would have to demonstrate that risks have been reduced so far as is reasonably practicable. We would each have to issue the acceptance of a design in a way that aligns with our own legal and regulatory processes.

Having said that, the safety objectives of all the major western countries are very similar and that is why, by working through the designs through organisations such as MDEP, we can come to a common view, which is then expressed in the terminology of our own country's legal systems.

Q192 Sir Robert Smith: Rolls-Royce's idea that maybe we could go to the US and agree a common standard that they could design to—

Dr Hall: Well, the US system has been established for many years, as has our own, and, as with all regulatory systems, their current form is a product of the history of the nuclear industries in those different countries. The US system is moving to become more risk-informed than it has traditionally been. We have had a risk-informed or risk-based system in the UK since 1974 with the Health and Safety at Work etc. Act. There are common areas. The standards in both countries

align very closely with the standards and guidance that the International Atomic Energy Agency has published over the years. That is why I say in terms of the fundamentals and the safety achieved that they are similar standards, but they just have to be expressed in different ways.

The only caution I would give, though, in terms of working with other regulators, and this is not a specific instance but a risk, is that the group could move at the speed of the slowest in the group. Although, usually speaking, you would expect that working in combination you would all come to a conclusion more readily, more speedily, in some cases if another country does not have the same priority for reactor design it might not move as quickly as ourselves or some others.

Q193 Graham Stringer: What are the key factors in siting small modular reactors? Are those key factors any different from traditional larger reactors?

Dr Hall: I think this comes down to the question on the claims for inherent safety, passive safety and so forth. It depends on what you mean by inherent safety. If it is, to my mind, physically impossible, i.e. it would break the laws of physics, for a reactor—

Graham Stringer: We will not do that then.

Dr Hall: No, you cannot do that. It might be that you could prove, with a reactor design, that it is impossible for the fuel to melt and release radioactive material to the environment, and there have been claims for some reactors in the past that that is the case. If that can be proven, there is no possibility of an offsite release and radiological consequences to the environment and that would mean that the siting options would be much broader than for other reactor types. With most reactors there will be some risk of an accident, no matter how remote, which would require offsite countermeasures to protect people and that would then affect the siting.

John Jenkins: Also security and transportation.

Dr Hall: Yes, the other issue is, of course, on security and transportation because the more sites you have around the country, the more movements you have of material. Depending on the type of fuel that is used in small modular reactors—it might be more highly enriched than the fuel currently used—those safety and security issues would have to be taken into account as well.

Q194 Graham Stringer: Do those reasons lead you to the conclusion that existing sites would be better and that it is still sensible to site small modular reactors away from large populations?

Dr Hall: As I say, unless a reactor is intrinsically inherently safe and cannot have the possibility of a serious accident, you should not site it in an urban area, but if you could demonstrate that it was inherently intrinsically safe, I think a case could be made.

Q195 Graham Stringer: You have just made the point, which is undoubtedly true, that there is nothing 100% safe, is there?

Dr Hall: No.

Q196 Graham Stringer: There is always a risk. Even if the risk was very low, would you put that small modular reactor close to densely populated areas?

Dr Hall: If there was a risk but that risk was low, I do not think the arguments would be fundamentally different from those around the large modern reactors because the levels of safety being achieved in those reactors are extremely high.

Q197 Graham Stringer: The other side to that question: does that lead you to the conclusion that we would be better off looking at current sites?

Dr Hall: The current sites have already been examined, but whether they would be available for small modular reactors is questionable. If I can just make one other point. Very often the proposals for small modular reactors involve having a number of the reactors on the same site. Although individually they might have less radioactivity in them, in combination they may have a similar amount of radioactivity and the potential for consequences that are similar to those of a larger reactor.

Q198 Graham Stringer: Are there any particular sites you would have in mind for small modular reactors? You have mentioned that you would have to modify the site. What exactly do you mean by that?

Dr Hall: When you have a smaller reactor, the requirements for cooling are lower. Whereas the current sites are all located on the coast, there would be a possibility that small modular reactors could be sited inland using rivers or lakes or cooling towers to achieve cooling. There would be some more flexibility in their deployment, but it would be for DECC to determine the siting policy for a further tranche of reactors.

Q199 Graham Stringer: Are there any specific sites that you think would be ideal?

Dr Hall: We have not done any analysis of that because there have been no proposals at present.

Q200 Graham Stringer: Do you think the Government should revisit sites that it has previously looked at and rejected because of the need for less water and the fact that they are smaller reactors, even if there are two or three of them on the site?

Dr Hall: That is a possibility, yes.

Chair: Do you want to come in, Dr Simper?

Dr Simper: Yes, if I may. I think another factor that we should consider is that many of the older sites have held the legacy reactors, which are quite small relative to the new larger reactors that are being proposed. Self-evidently, small reactors are smaller than large reactors. There may well be historic sites that, not just from a safety perspective but in terms of the infrastructure for

cooling and the infrastructure for distribution, might be inaccessible economically for a modern large gigawatt-scale reactor but might be able to support one or two small reactors. For example, the Trawsfynydd site in Snowdonia would very hard to upgrade to a large reactor, but it might be able to hold a small reactor. In addition to the safety features, there are issues of the installed infrastructure and the economics of deploying a large reactor rather than a small one.

Q201 Christopher Pincher: Dr Hall, I am a little confused by two statements that you have made. Hopefully, you can reconcile them. You said that existing sites' availability may be questionable, but you also said that you have not done any analysis of existing sites as to their suitability. I wonder if you can reconcile those two statements.

Dr Hall: Yes. First, in terms of the first statement, I believe the existing sites are already owned by utilities which have other plans for them. That is why I do not believe they are available for small modular reactors. In terms of assessments of sites, what I meant was we have not assessed any sites beyond those that have already been identified. We have not undertaken a speculative assessment of where might be a suitable location. That would be for a requesting party to decide and then, once they had identified a site, we could assess it.

Q202 Christopher Pincher: In your view, and perhaps, Dr Simper, you have a view as well, Sellafield would not be or may not be an appropriate site for a small reactor?

Dr Hall: It may or it may not. It would depend on the characteristics of that reactor. For a reactor design, assumptions will be made about the site characteristics, whether it is a hard site in terms of geology or a soft site, whether there is any level of seismic activity, and so on. You have to combine the specifics of a design and the assumptions that have been made in producing that design with the characteristics of a site to see whether a particular reactor design can be located there.

Dr Simper: I think it depends what we mean by the Sellafield site. The existing site itself is very busy and Sellafield Limited has a very important decommissioning job to focus on. There are many decades of important work there. I do not believe it would be in anybody's interest to distract anybody from that mission.

If you look at West Cumbria more generally, so around the site, there are already intentions, as you know, from NuGen to develop in the West Cumbrian vicinity. The current plans, as I understand them, are for quite large-scale development; so the implementation of gigawatt-scale reactors. NDA does not have a monopoly over the use of land and if utilities decide that West Cumbria is a good place to deploy small reactors, in addition to the nuclear activities already going on there, they are at liberty to acquire land and go through a siting process and make applications. This is very much a personal opinion, but I would have thought that, when you consider the activities at the Sellafield site and the planned development at NuGen around the Sellafield site, it is beginning to feel a little congested from a nuclear point of view.

Q203 Christopher Pincher: You think that the argument of developing a centre of excellence, even if that is quite widely distributed across the area, is countered by the congestion already in existence on the Sellafield site?

Dr Simper: No, I do not think I would go as far as that. From a centre of excellence point of view, I think it is self-evidently the case that West Cumbria provides the bulk of the UK's nuclear capability and is a natural location for people wishing to deploy nuclear technologies and develop them and experiment with them. From a point of view of an initial deployment of a small reactor, and we have to be careful what we mean by that, there may well be distinctions between a commercial deployment, in which case the utility will decide where to deploy it based upon its business needs, and the deployment of a technology for investigating that technology, in which case West Cumbria may well be a good choice. Other locations may also be good choices.

Q204 John Robertson: Dr Simper, can you update us on the NDA's work on the three credible options, including PRISM technology, for reuse of separated plutonium waste stocks?

Dr Simper: With pleasure. As I am sure the Committee is aware, we are currently looking at three technologies. That is General Electric Hitachi's PRISM reactor, which is a liquid metal-cooled fast reactor; CANDU's CANDU reactor, a heavy water reactor; and the potential use of light water reactor MOX, mixed oxide fuel, in the planned new build around the UK. The reason we are looking at those three options is that those are the three options that the market—General Electric Hitachi, CANDU and AREVA respectively—has proposed to us as solutions. We are not interested in developing technologies on a speculative basis. We are interested in solving our problem of what will be about 140 tonnes of separated plutonium. We are currently contracted with those three organisations to continue our development in investigating them. We continue to investigate technical matters such as what proportion of the plutonium stockpile could be managed through that proposed technology. Not all plutonium is created equally. It differs from stuff that is certainly suitable for any management route through to material that is maybe less suitable for some rather than others and some that ultimately, I am afraid, will be disposed of as waste.

There is technical work to be done. There is work with our colleagues in ONR on licensing aspects to ensure that those technologies are licensable within the UK's regulatory framework and, most importantly, the work that is going on at the moment to ensure that we have a credible route to bring those proposals to market. What I mean by that is just having the science right and the technology right does not mean that you could implement it. We have to think through where the money comes from; who is contracted to whom and for what; who bears what sorts of risk; how we bring in technology, vendors, builders, people with money, utilities—ultimately electricity needs to be a part of this—in order to create a solution that delivers the end point, which is that that UK separated plutonium stockpile is managed to the smallest amount.

Up to now, our focus has been very much on those technical aspects. There is no point in looking at commercial implementation issues for a technology that is simply not credible. Our emphasis is now moving on to saying, "Given that level of credibility we have from a technical point of view and the level of confidence we have from a licensability point of view, how could these solutions be brought to fruition?" Our aim is to have that work completed to be in a position by around about 2016 whereby we would know how we would go to the market to carry out an acquisition and allowing DECC and the Government more broadly to make a decision about whether at that point it wishes to proceed into implementation.

John Robertson: That was a very extensive answer, if I may say so, and you have just answered the next three of my questions, so well done you.

Dr Simper: We like to be efficient.

Q205 John Robertson: I do not often say that to people who sit in these seats, but that was an excellent answer. Thanks very much. Are civil nuclear waste and spent fuels dealt with in a different way from defence or medical nuclear materials and, if so, how?

Dr Simper: I am going to start by trying to make an important distinction between wastes and spent fuels. By definition spent fuels—the reason we use that phrase—contain waste within them, but they also contain potentially useful energy value in the uranium and the plutonium. There is a question about what you do with spent fuel and whether you wish to reprocess it to separate the wastes from the reusable components. Our current position is not a policy decision, but economically that does not work at the moment given the cost of uranium and the cost of enrichment versus the cost of reprocessing. Other countries balance security of supply issues and cost differently and come to different conclusions.

In all events, if you are talking about genuine waste—so that will be the cladding of fuel if you are reprocessing or chemical or physical materials that are used in the handling of nuclear material—then, to that extent, the management of the waste is the same in the NDA sector, the current civil nuclear sector, the defence sector and, indeed, with medical isotopes. We handle them all the same. The accountabilities sit with the people who own the materials, but we all work very closely on waste management techniques and waste management approaches so that we get the best possible solution.

Ultimately, the higher activity waste is destined for geological disposal, at least in England and Wales, and for long-term management at the surface in Scotland. NDA is accountable for implementing geological disposal and we are also accountable for lower-level waste disposal at the low-level waste repository near Drigg. All roads lead to NDA for waste management and we work closely with the waste producers to ensure that if there is a good technique it is used across the industry.

Q206 John Robertson: If we went down the road of reprocessing, how much of that would be usable, all of it or just some of it?

Dr Simper: If you are doing reprocessing, you end up with separated uranium and plutonium, which in principle you could use, and you will inevitably end up with the waste. The waste is not reusable. If we look at our history, we have been a reprocessing country. When we are talking about the waste we have currently, they are the wastes that arise from reprocessing. The uranium, 55,000 tonnes of it, and the plutonium, 140 tonnes of it, which we have just discussed, have already been separated from the spent fuel. When we talk around the about 1,000 metres cubed of high-level waste, about 250,000 metres cubed of intermediate level waste and about 4 million cubic metres of lower-level waste, that is all waste.

Q207 John Robertson: Gentlemen, I have not forgotten you. Feel free to comment on anything that has been said, but I have a question for the two of you. We have heard that some of the new reactor technologies such as PRISM have passive safety features, which will remove decay heat without operator action. How have you tested these claims?

Dr Hall: We have not been asked to assess those claims to date but, if we were, then we would go—

Q208 John Robertson: Can I just stop you? If you have not been asked to test them, who has? Nobody?

Dr Hall: So far as I am aware, nobody. I think maybe with PRISM there will have been some examination by the US regulator.

Q209 John Robertson: Okay, so back to what you were going to say. Sorry for interrupting you.

Dr Hall: If asked, what would happen is that we would examine the claims that the vendor was making. We would examine the arguments it was making that the passive safety features would work in all circumstances, and we would seek evidence that backed up those claims. We would undertake a technical assessment in the same way as we do for the current reactors. I would make some points. When these claims are made, it is important to understand whether particular assumptions underpin them and whether those assumptions might be invalidated. That, as a regulator, is one of the questions that we would ask.

For example, if you have natural circulation—and I am not specifically referring to PRISM here but a number of small reactors claim natural circulation—you have to ask the question as to whether there is some phenomenon that can interfere with that. If you have natural convection of air past a reactor vessel, for example, what could prevent that from happening? Well, flooding for a start. If you have flooding in an air inlet, you could cut off the natural circulation. That is something that we would wish to see the claims for. If you have an entirely passive system and the passive system fails for some reason, you then have no other options for controlling the system. You have to examine those passive systems and the claims very carefully to make sure there are not some circumstances when the passive system will fail.

Q210 John Robertson: GE Hitachi have said they have checked it and they have basically said it has "passive safety features that will remove decay heat without operator action and eliminate the risk of a loss of coolant accident, making it more resilient to external events." They have said that, but they can't prove it?

Dr Hall: They may be able to prove it, but they have not done so to our satisfaction yet.

John Robertson: Mr Jenkins, do you want to add to that?

John Jenkins: No, Andy is the expert on it.

Q211 John Robertson: I have one more question here. What challenges would ONR and NDA face if the UK decided to move to a different fuel cycle, for example from uranium to thorium?

Dr Hall: Right. Well, I think the first point to make about the thorium cycle is that thorium itself is not a fissile material. It cannot participate in a chain reaction itself. You have to breed uranium,

a particular isotope: 233, from the thorium in order to make it a chain reaction. The first thing you have to do is breed from the thorium, which means that, depending on the particular proposal, you may be automatically into reprocessing in order to sustain that cycle.

The other point is that, although it is said that the thorium cycle is more proliferation resistant, one of the reasons for that is the uranium that is bred by using thorium is much more radioactive than the plutonium and so you need remote handling. There are other issues associated with the thorium cycle that do not necessarily arise with either the once-through cycle or reprocessing of conventional fuels.

Q212 John Robertson: We ask this question because places like India, China and Scandinavia have large deposits of thorium.

Dr Hall: Yes.

Q213 John Robertson: Obviously, they would like to go down that road and China is a big player in the market these days.

Dr Hall: Yes. It is an alternative to using the uranium-plutonium cycle, but if you want to move into breeding, you could move into breeding by using uranium and fast reactors rather than the thorium cycle.

John Robertson: You have been nodding and shaking and everything there. Go ahead.

Dr Simper: I agree with everything that Dr Hall has said. From an NDA point of view, our accountabilities are for cleaning up the nuclear legacy and, apart from a very small quantity, the nuclear legacy does not contain any thorium reactors. The impact on NDA would be quite small, I would have thought.

John Robertson: Mr Jenkins, anything to add?

John Jenkins: No, nothing to add, thank you.

John Robertson: You are having an easy time.

Q214 Christopher Pincher: Back to plutonium, Dr Simper, you said we have 140 tonnes of the stuff.

Dr Simper: We will have at the end of reprocessing.

Q215 Christopher Pincher: Also, I think we have 87 tonnes stored at Sellafield, north of that maybe now?

Dr Simper: Yes.

Christopher Pincher: Do you have any sense of the proportion that is pure and impure, in layman's terms?

Dr Simper: Yes, we have a very good sense. We do not know for certain because some of the older material was packaged a long time ago and there are safety concerns associated with continually opening packages to see what we have. We are relying on records and the older records are, as I am sure you appreciate, the less they maybe suit your modern purposes.

As I said, there is a spectrum from probably of the order of about 5 tonnes that is unlikely to be cost effective to be converted into fuel for the reuse programme, and then a large quantity of the more recently produced plutonium is very suitable for use under any of the technologies. I think it is broadly true to say that the fast reactor system, PRISM, is probably more tolerant to impurities and variations in the product quality than the other systems.

One of the things we are doing is working at the moment with the vendors to understand what quantities of plutonium we will be able to use in what system with what additional costs for their treatment or, potentially, with what additional impact on the safety aspects of the fuel manufacturing. Older plutonium is more radioactive because of something called americium, which grows into it. That is a very long answer that failed to answer your question, I am afraid.

Q216 Christopher Pincher: Well, it leads me on because you say that PRISM claim that their technique is more tolerant and, therefore, they can process more impure plutonium with less chemical clean-up. First, do you think that has been tested thoroughly and, if it has, do you think that is a consideration when it comes to choosing a vendor; that one particular vendor can process more impure plutonium with less chemical clean-up?

Dr Simper: It has not been tested thoroughly. That is certainly the case. The particular range of materials that we have in the UK is unique to our particular history and our particular management and some of the chemical contaminations or the variety of plutonium isotopes that we have are quite unique to the UK's history. It has not been tested. It is a matter of theoretical science as opposed to a matter of demonstrated science.

As I say, I think we need to work with the vendors on understanding exactly what route we should go through. It is certainly an aspect of our decision, so we would certainly take it into account. If you have one technology that is enormously cost effective but only treats 1% of the inventory then you would not regard that as sensible or credible, but it is not the only factor. If you had one particular solution that was able to treat 85% and another one that was able to treat 90% but they differed very significantly in terms of their cost effectiveness then you would have to think very carefully about all the factors that are important to you. The percentage of the inventory that can be reused is certainly a factor but it is not the unique factor and I am not even sure it is the dominant factor, which is probably cost effectiveness and value for money.

Q217 Dr Whitehead: There is the Government-commissioned small modular reactor study currently under way, which I think is due to report this summer. What involvement have ONR and NDA had in that study?

Dr Hall: ONR is not part of that group but we have attended one of the meetings where we have answered questions on the licensing approach in a similar way to the questioning today.

Dr Simper: NDA's people talk to the relevant officials regularly and we have a very close relationship with them, but we have not been involved in the feasibility study in any formal or semi-formal sense.

Q218 Dr Whitehead: Is there a sense in which you should be involved to the extent of, at the very least, intelligence as to whether that then means the Government might be closer or further away from pursuing the deployment of small modular reactors and, therefore, the extent to which that would create some fairly immediate process steps for yourselves as regulators and decommissioning authority? Let us say the report hastened the adoption of small modular reactors by the Government. What would you then do immediately after that?

Dr Hall: One of the things we have done when we met with the group was to suggest that, as the regulator, we might undertake a very high-level feasibility study of a variety of different SMR designs. This would be a pre-generic design assessment overview. It would be high level and not looking into the detail, but at least we could gain some intelligence on the designs that way and feed back our initial views.

Q219 Dr Whitehead: In terms of a development in that particular field, would there be any new resource implications, for example, for the organisation?

Dr Hall: Well, if it were to move into generic design assessments, and this would depend upon DECC coming to us and saying that there was a design that had a realistic prospect of being deployed in the UK, that would go into the group of potential designs for generic design assessments and that clearly would have resource implications.

John Jenkins: It certainly would and we would look to be guided by DECC on which ones they wanted us to consider in a particular time. We have a limited amount of resource in ONR and the demographics of our organisation mean that that will be with us for at least the next three to five years. Our creation as a public corporation means that we are freer and more flexible to respond and anticipate those challenges and we are doing that, but the essential here is that we own all the regulatory-trained, warrant-holding resource other than the Defence Nuclear Safety Regulator. We bring people in with very high levels of training and experience and we have to train them. We have to convert them into regulators and that takes time and, therefore, is a lag.

Q220 Dr Whitehead: I can almost imagine some fairly straightforward resource implications such as, as we heard earlier, a number of sites that might previously have been regarded as beyond examination would perhaps come into potential examination in fairly large numbers as part of the regulatory process. Presumably that would consume quite a lot of unanticipated resources. Bearing in mind the question of having to train up regulators and so on, are there circumstances under which you could change the way you operate external assistance in order to deal with those sorts of regulatory issues or is that something you think would be easier to deal with in-house?

John Jenkins: We use technical support contractors at this time. We have a framework that we use them on. Of course, every other part of the industry uses those technical support contracts as well. The solution to it is to recruit, train and develop people right from graduate through to our normal area of recruitment, which is people from industry. That is what we are doing right now.

Dr Hall: If I might just come back on the timing, what we have found recently and part of the reason that we designed the generic design assessment process is that requesting parties, potential licensees, wanted to have our view as the regulator on the adequacy of a design and whether it could be built on a UK site without significant modifications before it went in for site selection. I think site selection itself would be a bit further down the road. The initial resource demand we would expect is in the technical assessment of the reactor design.

Q221 Dr Whitehead: Presumably there would be resource implications just on that point for NDA in terms of examining? If you had a large number of small sites, the questions of transport, storage and disposal would presumably assume a different dimension.

Dr Simper: I would not have thought that that would have been a resource implication for the NDA. Making the arguments around the suitability of the reactor technology system, including transport and so on, would be for the developer to satisfy the regulator through our established processes that that was appropriate. If they wish to use an NDA site or NDA land for that, we would be very happy to have the conversations about how that could be brought to fruition and there would be a small amount of commercial and legal resource required in NDA for that. We talk about the reuse of our land all the time. That is a routine part of NDA's business, to try to get our land reused to deliver social benefit. In terms of the deployment of the technology and all the issues that would have to be addressed in doing that, that would not be an NDA responsibility. That would be very much for the developer and for the regulator.

Q222 Dr Whitehead: This is a question more or less born of ignorance. What sort of implications in terms of resources would a large number of sites and their security and their resilience raise in the authority as far as its regulatory role is concerned?

John Jenkins: We have done some medium-term planning, as one would expect, in terms of resource need, which shows a significant and sharp increase from now that will peak around 2020-25. We need to make sure we have a richness of our staff to ensure that we can respond to the transportation and security matters and, indeed, safety between now and then, at a time of maximum churn as far as demographic change is concerned. That is our planning. There will always be specific cases that sit within those layers, but our whole forward-licensing regime, which I think was the specific point you were talking about, is geared around that eventuality.

Q223 Chair: We started this inquiry because not all, but a majority of the Committee are very supportive of the nuclear industry and would like to see a new generation of civil nuclear power stations built. Not all, but the majority of us think that that is an important component in the energy mix in the UK. Obviously, there has been a concern about the length of time it takes to get a new nuclear power station built and, of course, the costs of trying to do so entirely with private finance rather than with any public subsidy. We have seen all that played out in the saga about Hinkley Point.

One of the reasons we started this inquiry is to see whether there might be a faster track if we adopted a different approach to this, and whether small nuclear offered any faster track. We have only one more evidence session now, with the Minister, but my own impression is that it is not at all clear. We have had various commercial organisations coming and basically flogging their wares to us and I think you have helpfully put all that in a good context. I reiterate what I said earlier. I

think that one of the reasons why the British public are more supportive than the public in many other countries of the idea of more nuclear power stations is the confidence they have in the way that you and your respective organisations are doing your jobs. I think that is a tribute to you but it is also a great asset to the UK. That is the case.

However, can we now exploit this in a way that will generate any electricity before 2030? That is the question. Is there any advice you offer us when we come to write our report? We have had some success in influencing the Government on a number of other aspects of energy policy in the last four years and we chose this because it appears to be a live issue on which the Government's policy is not yet determined. Is there any advice you would offer us about whether there is, indeed, an opportunity for small nuclear to be one way in which we could either accelerate or cut the costs associated with the existing, rather more conventional approach?

Dr Hall: I think you are right that the GDA and licensing process necessarily has to take its time. We wish it to be efficient. We learn from others where we can. There is a lesson for the requesting parties and that is that preparation for submitting a proposal is vital. They need to understand the UK regulatory system. We are very happy to talk to them about that and help them gain that understanding, but preparation is vital. They need to provide the safety submissions on the dates that they say they will. They need to make sure that they answer the questions that we are likely to ask. The questions we are likely to ask are all published in our safety assessment principles, which you can read on the internet. There is nothing secretive about that.

In terms of the options that are made available by the use of small modular reactors, they tend to be more commercial advantages. For example, there is a long lead time on major pressure vessels for the very large reactors. By going to smaller reactors, you can bypass that queue and, therefore, get a reactor on to a site more rapidly. Looking back at our previous experience with the reactors we have been putting through GDA, the EPR and AP1000, what you see is that the timescales are not being governed by ourselves and the GDA process but by other matters, essentially commercial matters, European matters, and so forth. We are not the rate-limiting factor. These other significant issues have to be resolved to speed up the process.

Dr Simper: When I think about the classification of radioactive waste into higher activity waste and lower activity waste, the advice I would give is to not be too concerned about classification. Whether it is a small reactor or a large reactor in a classification sense seems to me to be less important than whether that is the right technology with the right scale with the right features for deployment on a particular site to meet a particular need, whether that be electricity generation need or whether that be the commercial needs of the deployer. Although small reactors as a concept provides a nice piece of structure to enable thinking, I think it can be counterproductive when you then start to make decisions that are based upon arbitrary classification.

In the case of some of the reactor systems we are talking about, there are features of them in relation to, potentially, their capital cost or their offsite build that might be attractive, or their demand upon infrastructure, and we spoke about cooling or distribution assets. There may also be some features that are unhelpful in relation to the power density you get. If you want a lot of electricity, use a big reactor. If you want a small amount of electricity, use a small one. I think the only piece of advice I would be giving would be to avoid, if at all possible, an approach that seeks to use classification to drive policy making as opposed to considering the facts of the matter and the suitability of a particular solution for a particular need.

Q224 Chair: Out of interest, Dr Hall, you referred to the difference that we have a goal-based regulatory system and other countries have a rules-based system. I personally am convinced of the superiority of our approach and we have seen that to good effect in other industries. One of the first inquiries we did in this Parliament was on the Gulf of Mexico BP oil spill. We concluded then that, under our goal-based, risk-based assessment for regulating offshore oil and gas activities, it might well be that the risk of that accident happening would have been very much lower than the US using a strictly rules-based system. Having said all that, is it the case that it may take longer or it may be more complex for a prospective developer of a nuclear power station to obtain approval under our system than if they merely have to show they can obey a set of rules?

Dr Hall: I think it is quite the contrary position. I remember a few years ago attending a fuel cycle information exchange meeting in the USA that had been arranged by the US regulators. The main question during that conference was the licensing of new fuel cycle facilities. When you have a prescriptive rule-based system, the regulator has to go through a lengthy process of understanding the technologies, deciding on the standards, and then promulgating the rules. It was quite clear to me that the rule making was a significant drag on the introduction of new fuel cycle facilities.

The same applies to the introduction of new reactor types in the UK. As the regulator, we do not have to go through a lengthy rule-making process in order to enable a licensee to make an application. It can come to us and essentially it then has the opportunity to make the case for safety, to set out the standards that it is seeking to achieve, to set out how it is going to manage the risk associated with nuclear hazard, and then, as the regulator, we can come back and assess that. That is what we have done with a wide range of technologies in the UK. We may be unique as a nuclear safety regulator in the range of different facilities we regulate, from reactors, fuel reprocessing plants, defence sites, and so on. That has been enabled by this goal-setting approach that we have.

Q225 Graham Stringer: Just to follow the Chairman's question, although your regulation is risk based, would your advice be, if we wanted to encourage more investment in nuclear and to have more nuclear power reactors to stay as close to the current technology that we have as it is possible to do—is the implication of what you are saying that, although your regulatory system may be superior to a rules-based one, it does require more work if you move away? While there are attractions to the thorium cycle, it would presumably require quite a lot more work. Should we not avoid the AGR mistake that was made some time ago and stay as close to the technology that we have as we can do?

Dr Hall: I think it is clearly going to be easier to adopt an evolutionary approach, both for licensees because they do not have to develop vast new skill sets and for ourselves for similar reasons, where you work with an existing design or a class of designs like pressurised water reactors or boiling water reactors and then almost play tunes on that, rather than go to a completely different technology such as metal-cooled reactors or the thorium cycle. The further you move away from the area that the industry and ourselves understand very well, the more the work that will need to be done and the more the investment that will be needed in order to prepare both sides to deploy that technology.

Chair: Thank you very much, very interesting session. You have been very helpful witnesses. We much appreciate your contribution.