

Science and Technology Committee

Oral evidence: Delivering Nuclear Power, HC 626

Wednesday 14 December 2022

Ordered by the House of Commons to be published on 14 December 2022.

[Watch the meeting](#)

Members present: Greg Clark (Chair); Aaron Bell; Rebecca Long Bailey; Stephen Metcalfe; Graham Stringer.

Questions 286 - 383

Witnesses

[I](#): Professor Claire Corkhill, Member, Committee on Radioactive Waste Management; Dr Robin Taylor, Senior Research Fellow, National Nuclear Laboratory; and Professor Katherine Morris, Lead for Nuclear Environment and Waste Management, Dalton Nuclear Institute.

[II](#): Janne Mokka, President and CEO, Posiva Oy; and Claes Thegerström, Former President, Swedish Nuclear Fuel and Waste Management Co.

[III](#): Clive Nixon, Group Chief Nuclear Strategy Officer, Nuclear Decommissioning Authority; and Corhyn Parr, Chief Executive Officer, Nuclear Waste Services.

Examination of witnesses

Witnesses: Professor Claire Corkhill, Dr Robin Taylor and Professor Katherine Morris.

Q286 **Chair:** The Science and Technology Committee is in session, continuing our inquiry into delivering nuclear power. I am pleased to welcome our first panel of witnesses this morning. Professor Claire Corkhill is a member of the Committee on Radioactive Waste Management. Professor Corkhill holds the chair in nuclear materials degradation at the University of Sheffield. Dr Robin Taylor is senior fellow at the UK's National Nuclear Laboratory and chair of the OECD Nuclear Energy Agency Expert Group on Fuel Recycling and Waste Technology. Professor Katherine Morris is the Dalton Nuclear Institute's theme lead for nuclear environment and waste and holds the BNFL chair at the University of Manchester. She also holds the role of director of the radioactive waste management research support office, a dedicated office co-ordinated between the Universities of Manchester and Sheffield and involving 20 universities.

As is apparent from their biographies, we are interested this morning in decommissioning and the management of nuclear waste. Let me start with a question to Professor Corkhill, and perhaps also Professor Morris. Tell us about the decommissioning process. Why is it so complex and expensive?

Professor Corkhill: I am speaking today on behalf of the Committee on Radioactive Waste Management. We provide independent scrutiny and advice to the UK Government and devolved Administrations on radioactive waste management and disposal.

The perspective we can give on decommissioning comes from the visit that we made to Sellafield last year. I do not know if the Committee has been to Sellafield, but it is very interesting.

Chair: Some of us have individually.

Professor Corkhill: We had a two-day visit there and saw at first hand some of the complexities of decommissioning. The main point to highlight is that it is the management of the complexity that is the challenge. There are many different moving parts and groups of people that have to interact, communicate and share the same goals, so that they can get to the final point where buildings are decommissioned.

We saw the Magnox swarf storage silo facility, which is leaking radioactive effluent into the ground. The ONR has commissioned action to try to clean that up. When we saw the facility, and the decommissioning operation, it was likened to emptying a dustbin with a teaspoon. They have to take out individual pieces of waste one at a time and assess them before they can, ultimately, empty the entire building so that they can fix the leak. That complexity involves many moving parts and lots of



HOUSE OF COMMONS

organisation, in terms of management. It is understandable that because of that, and the level of hazard, it will take a considerable time.

Our overall impression was that the site requires stability and long-term commitment in policy and funding, to enable it to plan the management of its own activities and to retain and develop its skilled workforce. That is an issue at the moment because many people are reaching the end of their career and there is not necessarily a younger skilled workforce to take it up.

One of the other things that was really evident on our visit was that the lack of certainty on a delivery date for a geological disposal facility somewhat constrains the timescales for decommissioning, and increases uncertainty in planning the decommissioning. While there is a first waste emplacement date for the geological disposal facility of the 2050s, a number—by no means all—of the employees we spoke to were very sceptical. That scepticism about there being a geological disposal facility pervades in the planning. For every 10 years without a geological disposal facility Sellafield needs to build another store, and each store costs several hundred million pounds.

Q287 Chair: There is a lot there that we need to unpack. Let me ask a couple of questions arising from what you said. You said that the lack of a disposal facility constrains decommissioning. How can that be the case, since decommissioning has to start once it is deemed unsafe to continue to use a reactor, and decommissioning is happening apace? I can see that it might pose problems, but how can it constrain decommissioning?

Professor Corkhill: I am focusing mainly on the Sellafield site in this discussion, because that is what CoRWM has experience on. If a building is identified as hazardous, it can only be deconstructed and decommissioned if there is space to take the waste that is going to come from that decommissioning. At the Sellafield site they are extremely constrained on space. They need to build a store to take the waste for every facility that is decommissioned, but they do not have the space to do that, so until we have an alternative place to put the waste—for example, a geological disposal facility—it becomes difficult to decommission those buildings. Hazardous buildings that need deconstruction are put into what we call care and maintenance. They are looked after until such time as they can be decommissioned.

Q288 Chair: That is buildings. But with the nuclear reactors that are being decommissioned because they are coming to the end of their life, what happens to the products there that need to be safely taken care of, if not permanently disposed of? Are you saying that Sellafield cannot accommodate them?

Professor Corkhill: My understanding is that, for example, the fuels that come from those reactors are transferred to Sellafield. Sellafield has space to look after those materials. It is my understanding that decommissioning of the reactor buildings themselves—for example, the



HOUSE OF COMMONS

Magnox reactors—is moving forward apace; but that is not something that CoRWM has specific expertise in.

- Q289 **Chair:** Okay. Professor Morris, tell us about decommissioning. We have heard some of the constraints that Sellafield has. I guess there are two questions in my mind. Does it impose practical difficulties for the reactors that are now at the end of their life and are being decommissioned? Is there something that the Committee should know about that? Secondly, since our inquiry is about the future of nuclear power, what are the implications of that for commissioning new nuclear power stations?

Professor Morris: That is quite a big question, so thank you for that. Claire focused on Sellafield because that dominates the estimated cost of decommissioning, at three quarters of the total; but you rightly refer to the wider decommissioning efforts. To reiterate and reinforce what Claire said, the spent nuclear fuel from those facilities is discharged and will be moved to our central facility at Sellafield for the AGRs. Then you go through the decommissioning process on site. As Claire has alluded to, if you cannot dispose of those materials, you have to store them until the disposal facility becomes available. From experience, one would assume that the majority of those materials will be low-level wastes, and there will be some associated intermediate-level waste. We can build robust stores to manage those materials but, ultimately, the disposal path is the end way to deal with those materials.

- Q290 **Chair:** Given that we have materials for which there is currently no long-term disposal facility—they are, effectively, held on a provisional basis in Sellafield and other places and that has proved adequate, if not satisfactory at the current time—what are the implications for new nuclear? Ought it to be contingent on having in place a geological disposal facility, or could we add to the existing stocks?

Professor Morris: Geological disposal of higher-activity waste and new nuclear must step hand in hand. There is reliance on a GDF for new nuclear, in that sense. The phrase is “a credible pathway to management of the materials.” In simple terms, storage has got us this far, but with the vision and progress around the GDF happening now, my personal opinion is that we must focus on delivery of the GDF and on the new nuclear programme, and they should be in balance. They should be step by step.

- Q291 **Chair:** We have Hinkley Point C under construction. Do you think that should not have gone ahead because there isn’t a GDF?

Professor Morris: No, I think we are making good progress on a GDF, and a credible pathway to a GDF is foreseen. Certainly in my career this is the time when I can foresee the most progress on the GDF path, so I think we have to have credible pathways for the waste. Maybe CoRWM has a view on that. Claire may have a view; I don’t know.

- Q292 **Chair:** What Professor Corkhill said about Sellafield I have seen myself; there are the ponds, the contents of which are not entirely known. She



HOUSE OF COMMONS

has given evidence that there is some leakage into the ground. How can we learn lessons from that? Competent people were responsible for administering that. How can we have confidence today, when it seems that at the very least there was a series of great errors, that this generation will not make some?

Professor Morris: That is a good question. We have a long history at Sellafield. In terms of what we can learn, my strong personal opinion is that one must consider cradle to grave, and integrate across from new nuclear to integrated waste management and ultimately disposal. The other comment that I have on Sellafield is that you would not start here. My strong belief is that we should move forward with new power, with decommissioning and waste management integrated in the forward plan, so that we can move forward on new nuclear with confidence that the waste has a credible pathway.

Q293 **Chair:** The people who were responsible for building facilities that are now such a hazard to the environment were, I am sure, scientifically accomplished, presumably well motivated, and all the rest of it. Why should we have confidence that people with similar attributes now will not be subject to the mistakes they made?

Professor Morris: I believe that the waste management aspect of things needs to be integrated step by step, and that the systems and processes are in place to do that for new nuclear. We are talking about large gigawatt reactors that have fuel similar to the Sizewell B facility and so forth.

Q294 **Chair:** Are the procedures better now than they were when this nuclear waste was first shipped, and stored at Sellafield?

Professor Morris: I think the environment has changed.

Q295 **Chair:** Dr Taylor?

Dr Taylor: Going back to your original question, most of the cost and complexity of the decommissioning comes from the very early days of nuclear, the 1950s and '60s particularly—the civil power and defence programmes. The technical challenges that Claire talked about arise from the fact that the drivers were different back then. Now I think we understand the wastes. We understand the need for building decommissioning into the design of new plants, and making sure that we consider the full life cycle, as Professor Morris said. It is really important to think about that and to make sure that there is a direction—a strategy—all the way through for the full fuel cycle; not just the development of the reactors themselves, but provision of the fuel and the treatment of the spent fuel, and the decommissioning, which generates an intermediate-level waste.

Chair: Thank you. I am going to go to my colleagues, starting with Graham Stringer, and then Aaron Bell.



HOUSE OF COMMONS

Q296 **Graham Stringer:** Dr Taylor, can you tell us a bit about the National Nuclear Laboratory? I went to it about 10 years ago and it seemed massively underutilised then. Is it fully utilised now?

Dr Taylor: I would like to think so, yes. The National Nuclear Laboratory is Government-owned. BEIS is the owner. Our mission is to do nuclear science that benefits society. We have a number of focus areas related to environmental restoration, security, non-proliferation, clean energy and health and nuclear medicine. We work across those areas. We have a number of unique facilities in the UK, particularly the Preston laboratory for nuclear fuels research; the Central Laboratory at Sellafield, which is where we can do all the plutonium work, higher-activity work; and the Windscale laboratory at the Sellafield site, which is for post-irradiation examination of fuel.

Q297 **Graham Stringer:** Thank you. I got the impression, when I went, that there was not the funding to fully use it, but you are saying that it is fully used now.

Dr Taylor: We are not directly Government funded. We have to earn our programmes. One programme I would like to highlight was funded by BEIS as part of its energy innovation programme over the last few years. That was the Advanced Fuel Cycle Programme. It was a major programme for us—R&D in terms of fuels and fuel cycle research. That enabled us to fully utilise those facilities.

Q298 **Graham Stringer:** Professor Corkhill, going back to my trip to Sellafield, I was told that they were not sure what was in the pools or ponds of nuclear waste that they have. Is that the case? If it is, does that add extra costs and complexity to getting rid of that waste and dealing with it?

Professor Corkhill: Absolutely. You are right; that is my understanding. If we take the Magnox swarf storage silo that we visited, they are essentially like giant grain silos full of water, and all sorts of decommissioning wastes were thrown into them. The Chair asked about the design of those facilities. They were not designed for decommissioning. They were not designed necessarily for those bits of material to be taken back out again. They had not planned for that when they built the silos. It was a decision that was made because of the need for a high throughput of nuclear energy generation at the time.

Those materials are now sitting at the bottom. They have had cameras in. They have looked to see what is in there and they understand roughly what is in there, but only through visual examination rather than by good record-keeping. As you say, every single piece must be lifted out. It is like a giant fairground grabber. They pull it up, look at every single piece and work out what needs to be done with it. What is the dose? Does it need to be size-reduced before it can be moved to a container? Every single piece has to be examined before they can then put it into a form that can be stored.



Q299 **Graham Stringer:** I understood, before we started this inquiry, that one of the key factors in deciding whether to invest in nuclear power stations was the cost of decommissioning. One of our witnesses said that because there is so much waste to be dealt with now, those costs were marginal. Is that accurate? Is that true?

Professor Corkhill: I don't know the exact figures myself, but my impression would be that that is correct. The cost of dealing with the legacy waste far outweighs the management of radioactive waste today. We now have very good waste management practices for waste arising from current nuclear power stations and those that are planned in the near future. There are financing models to deal with that. It is the legacy of the bad decisions that were made in the past, or decisions that were not thought through properly with—as both my colleagues have said today—the full life cycle in mind, that takes up the majority of the cost.

Q300 **Graham Stringer:** We have also had evidence from witnesses that new nuclear reactors should not be commissioned until we are certain, or until we actually have a geological disposal facility. Do you agree with that?

Professor Corkhill: The Government's position is very clear. There is a policy in place—the working with communities policy—to implement a geological disposal facility. That policy is in place and is progressing. Because we have a policy, we therefore have a method by which to dispose of radioactive waste.

Another position on that is with the green taxonomy. I believe you were briefed on that. In the European green taxonomy, they have decided to include nuclear as a green technology, because there is a pathway to disposing of radioactive waste. It may be that in this country we do not yet have a facility. In other countries, Finland is close to having theirs, and there are operational facilities for other waste in the US; but we are now making good progress towards implementing a policy to dispose of radioactive waste in a geological disposal facility.

Q301 **Graham Stringer:** I don't want to be nit-picking, but having a policy is not the same as having the facility, is it? The point that was made was that you need the facility there before you commission the nuclear power station.

Professor Corkhill: I think this comes to something called the page 99 test. I'm afraid that I am not going to be able to recall the exact wording correctly. The gist of the page 99 test is that having a policy in place for a geological disposal facility is enough for the Minister to agree to the building of a new nuclear power station. I am afraid I do not know the details of that, but I can provide it in writing.

Q302 **Chair:** What does page 99 refer to, as a matter of interest?

Professor Corkhill: I know someone who is sitting at the back, who knows the answer to that, if I may—



HOUSE OF COMMONS

Q303 **Chair:** Perhaps you would write to the Committee afterwards. It is an intriguing thought; I have never heard of such a test before.

Professor Morris: I think it is the energy White Paper in 2008 that, on page 99, has a statement. It is the credible pathway-type statement that I was referring to.

Professor Corkhill: Thank you.

Dr Taylor: It is also worth noting that spent fuel from the new nuclear reactors will have to be stored for 60 to 80 years to cool, probably at the reactors, before it is moved to the geological repository, so there is the time for that storage. There are other means of dealing with spent fuels, such as recycling them, but we will need a geological disposal facility for the legacy waste certainly, and, as Professor Corkhill was saying, that is moving on quite well now.

Q304 **Graham Stringer:** Can we have some ballpark figures for the likely decommissioning disposal costs of the new set of nuclear reactors, and the estimated cost of dealing with the waste we have now?

Professor Corkhill: The geological disposal facility is projected to cost between £20 billion and £53 billion. For that geological disposal facility, at the moment the cost basis is on 16 GW of nuclear energy and the legacy waste.

Q305 **Graham Stringer:** Does that cover all the costs? It won't just be building the facility, will it?

Professor Corkhill: That is the projected cost of the infrastructure project in its entirety, yes.

Q306 **Graham Stringer:** And the cost of dealing with all the waste at the moment.

Professor Corkhill: I think the Sellafield cost of decommissioning—I am going to have to guess. I believe it is somewhere in the order of £150 billion, but I am going to have to check. That doesn't sound unreasonable.

Professor Morris: I would endorse that. We can check the current information and supply that in written evidence.

Professor Corkhill: I think you are hearing from the Nuclear Decommissioning Authority in the next session. They will be able to give you the definite, precise figures.

Graham Stringer: I think that is it, thank you.

Q307 **Aaron Bell:** Thank you all for your time today. I am going to continue on the geological disposal facility proposal. Can I assume that all three of you are in favour of us building one in the UK? That seems to be what I have gathered so far.



Professor Morris: That is my view, yes.

Dr Taylor: Yes. We need a geological disposal facility to manage the legacy wastes and wastes from new build. The technical questions are more about the size and the inventory, and the materials that go in it, noting that you have different types of waste: intermediate-level waste, high-level waste and spent fuel. We certainly need one, whatever fuel cycle we choose.

Q308 **Aaron Bell:** Professor Corkhill, it was your committee, I think, that first recommended this. You may not have been on it at the time, as it was 16 years ago.

Professor Corkhill: That's right. It was a while ago, but the very first committee of CoRWM was very interesting. It was formed in 2003 and was a bit like a citizens' jury. It had experts in radioactive waste, some regulators and some NGOs. It had everybody from a range of different opinions, and there was a consensus opinion from that first committee; they published a series of recommendations in 2006 and the very first one is that geological disposal is the best available approach for dealing with our higher-activity waste.

Q309 **Aaron Bell:** In 2018 the Government published an updated framework. That is 12 years later. In that framework the Government estimated that the process of identifying and selecting a site, not even building it, would take another 15 to 20 years. Why has progress been so slow on this, Professor Corkhill?

Professor Corkhill: It is an interesting question. Speed is a subjective term. I think it is actually moving quite quickly compared with how it has happened in other countries. I know you are going to hear other international examples later this morning. In Sweden it took them 30 years from firing the starting gun to getting to a host community, to a place where they are now applying for licences. We are moving quite quickly in comparison with other examples.

There is a tension about trying to speed up the process so that we can get a geological disposal facility site, alleviate some of the decommissioning issues that I alluded to earlier and have confidence in moving forward with our new nuclear policy; but that is tensioned against the fact that we are quite rightly running a voluntary process to find a geological community—a community who want to host the site—and that takes time. These are ordinary people who are trying to deal all of a sudden with a very big challenge. They are doing their everyday jobs and then meeting in the evening to work out "How exactly is this geological disposal facility going to affect me in my everyday life?" Then they have to get to a position where everybody in the local community is on board. They have to agree via what we call a test of public support, which could look exactly as the community would like it to look, probably a referendum. That has to pass before we can even get to the point where



we have a geological facility. That takes time. People are not employed to do this. They are doing it in a voluntary way.

Q310 **Aaron Bell:** What if we cannot get there? What if we cannot find a voluntary community? What is the future if we go ahead with new nuclear, but because of planning issues, as you have alluded to, we have new nuclear and all the legacy as well, and we don't have a GDF? What does that look like?

Professor Corkhill: It is a valid question but I would take a step back and ask what we need to do to reduce the risk of that community not coming forward. There are a number of things that NWS, the implementing organisation, is working on, and can work on. It probably needs a little more support from certain areas to get that consent from a community. I think it is entirely possible that we will get to the position where we have a consenting community, but we need to ask what we need to do to help support NWS to get to that.

Q311 **Aaron Bell:** What sort of support do you mean?

Professor Corkhill: There are a number of things. There are three key areas particularly where Government support is required for NWS. One is in public financing. The budget of NWS at the moment is about £100 million a year. That will need to ramp up quickly to try to address the needs of developing the programme and the community consent.

Probably the second thing—a present issue—is to do with delegate Cabinet Office checking. At the moment there are some issues with communities being able to access community investment funding. Each community that is involved in the process is allowed to bid for up to £1 million a year at this stage of the process. Later that will increase to £2.5 million. Every purchase that has to be made has to go for approval through the Cabinet Office, even very small things like printing. When it takes months to get approval for something very small, it grows mistrust. Even very small issues like that can undermine the whole process. There may be a possibility of looking at a different funding model, to try to help the community partnerships to move forward.

It also needs, generally, the support of MPs. Because the policy is working on the principle of community volunteerism, local MPs need to be on top of it, so that they can respond to their constituents. I am not saying that that has not been the case so far, but it is another way the Government can support NWS.

Q312 **Aaron Bell:** Dr Taylor, you talked about what might need to go into a GDF. Do you think that the current plans for what we would store in a GDF are the right ones?

Dr Taylor: Where we are now, yes, we need to plan for a GDF to take these fuels. It is the simplest option for the spent fuel and also the intermediate and high-level waste, which has to be geologically disposed of. It is important that we look to the future and the fact that things could



HOUSE OF COMMONS

change over the course of the many decades that the process will take, essentially hedging our bets with some of the other technologies that would be available.

Q313 Aaron Bell: In the capacity we would then build, would it be difficult to expand such a facility once it had already been built, because it is deep underground and would require a lot of excavation? Would it be possible to continue to expand it depending on where our future nuclear fleet takes us?

Dr Taylor: Maybe Professor Corkhill can answer for the role of CoRWM, but I believe it is a phased approach.

Professor Corkhill: Yes, absolutely. The current policy is for 16 GW of nuclear power and that will probably be increased to 24 GW when the radioactive waste substances policy is consulted on next year. There is no reason why we cannot select a site that has enough room for the waste from that ambition of nuclear power.

Q314 Aaron Bell: Professor Morris, Professor Corkhill talked about the establishment of Nuclear Waste Services. Do you think that has been a big step forward in solving this problem? Given everything we have heard so far, in the best-case scenario when do you think we might have a GDF that could start accepting waste in this country?

Professor Morris: On your first question, the formation of Nuclear Waste Services essentially gave an umbrella to low-level, intermediate-level and high-level waste disposal capability in the UK. Yes is my answer. That whole-cycle thinking in waste management is welcomed and, as we move forward, we will feel the benefits of that integrated organisation challenge to think in an integrated way.

Sorry, what was the second part of your question?

Q315 Aaron Bell: The date for the GDF under the best-case scenario, and maybe the worst-case scenario as well.

Professor Morris: In my personal opinion, as I have stated already in giving evidence here, it is important to note that progress on the GDF is the most it has been during my career. I am optimistic. Given the timeline you stated—15 to 20 years for siting—you start to look towards mid-century. I maintain that that is a credible timeline for us to deliver with the policy we have.

Q316 Aaron Bell: Professor Corkhill, we will be hearing from other countries in the next session. What lessons are we already learning from what is going on, particularly in Finland, at the moment?

Professor Corkhill: That is a great question. In some ways, it is difficult to draw exact parallels with other countries because they have different waste inventories, different geology and different relationships between their populations and their Governments from what we have here. However, what we have been able to see in Finland is that it is possible to



HOUSE OF COMMONS

get to the stage where you can construct; you can have a licence and build a repository. We have seen that having a programme of 30 years or more of research and innovation to underpin the safety of the facility is essential, and learning from that is being applied in many other countries across Europe right now. That science and innovation ultimately got Finland to the point where it applied for a licence from the regulator and it was approved. It has been an exemplar.

Sweden has followed suit. Its safety case came unstuck at one point because independent academics took issue with some of the research that had been done. Exactly the same research had been done in Finland and it had been approved in Finland, but because of a slightly different Government mechanism, there was an opportunity to raise a question and the process was halted for a while. There was a four-year delay until the licence was ultimately granted. The main takeaway message is that it can be done; it is possible, and we have seen the pathway to doing that.

Going back to your previous question about first waste emplacement, our committee believes that a first waste emplacement date during the 2050s is possible, as per NWS's plans and the SRO letter to Karen Wheeler, but we think that there are identifiable risks that have to be managed if we are to get to that stage. The main one, as I said earlier, is finding a willing community and suitable geology, and then it is all about obtaining the information to submit licences for permissions. That was the process I just explained to you.

Q317 **Aaron Bell:** The 2050s is the best case basically and, given the way all these things tend to go, it could well be the '60s or '70s before we have one.

Professor Corkhill: We are confident that it could be the 2050s.

Q318 **Aaron Bell:** But that is still the best case?

Professor Corkhill: Between the 2050s and 2060s.

Q319 **Chair:** Professor Morris, why do we need a GDF? For 50 years we have managed without one. If it is to be in the middle of the century, we will have had a century of storing nuclear waste without a GDF. In your view what makes it so essential that we have one?

Professor Morris: To distil it, my belief is that for higher-active wastes we have always had a pathway. Geological disposal has always been part of the framework. Therefore, the delays in geological disposal have got us to the stage we are at now.

Q320 **Chair:** Why has it always been the end goal? If we can store it safely for a century, why can't we store it for a couple more centuries?

Professor Morris: In simple terms, earth surface storage, in my opinion, has risk that is mitigated by disposal.

Q321 **Chair:** What are the risks of storing it on the surface as we do?



HOUSE OF COMMONS

Professor Morris: A surface store is certainly achievable and stable over decades. There is renewal of those stores; the stores in themselves are engineered facilities, so there is the associated cost of renewal. In terms of risk, if it is at earth surface there is a greater challenge to safe storage over the time it will take the material to undergo radioactive decay. The materials decay over tens of thousands of years, so if you think about the earth's surface over that future timescale and consider the way societies might evolve, you start to understand that disposal is a final credible solution for the intensely radioactive materials.

Q322 **Chair:** I can see that it might have associated finality, in that you bury it and can never take it out again, compared with something on the surface that is movable, but if something has been managed safely on the surface for 50 years and will be for another 50 years, and we are talking about mid-century, or perhaps 30 or 40 years, we can do it. Is this just a kind of tidiness? What is the elevated risk in storing it as we do compared with a geological facility?

Professor Morris: A geological facility offers certainty about management of that material. A surface store is credible over decades and beyond, but certainty over tens of thousands of years is where the discussion comes in, if that makes sense.

Q323 **Chair:** Professor Corkhill, there is a difference between having a policy and having a facility. Graham asked about this. We have had a policy for a very long time. Growing up on Teesside I remember a proposal for a facility under Billingham. When I was in the Business Department in the 1990s boreholes were drilled and it was going to be in west Cumbria. We have always had a policy. Is there a danger that we have constructed a device to tick a box by eliding having a policy, which is comparatively easy, with a facility, which is not?

Professor Corkhill: It has never been the intention to have a tick-box exercise. What I think has happened in the various iterations of the geological disposal facility siting process is that each time it has not resulted in a site those responsible have learned from that and decided, "Oh, actually this is a much better way to do it." With the current siting process, we are now in a position we have never been in before. We have four communities engaged as community partners to explore whether their area might have a suitable host geology. Many lessons have been learned from how those processes happened in the past. There is a driver to get this facility; it is not just a tick-box exercise.

Q324 **Chair:** Which are those four communities?

Professor Corkhill: Theddlethorpe in Lincolnshire, south Copeland, mid-Copeland, and Allerdale in Cumbria.

Q325 **Chair:** In effect, few areas. I concede that they are different villages and council areas, but you have west Cumbria and Lincolnshire.



Professor Corkhill: Exactly. It is our opinion as a committee that the greatest risk to delivering this facility is getting the host community buy-in agreement. It could be beneficial to have more communities involved. At the moment, NWS is constrained in doing that by budget. It would like to have more communities, but it only has enough budget to run four.

Q326 **Chair:** Leaving aside community support—obviously, I understand why it is important—what is the optimal place geologically in the United Kingdom to have this facility?

Professor Corkhill: I don't want to say a place because I will probably get some upsetting emails from people who live there, but what we are looking for is a geology that has very low permeability; for example, clay is a very good host rock. The French are building their repository in the same clay, Callovo-Oxfordian clay, that comes up through central England. That kind of clay is a perfect type of geology. It does not occur everywhere in the UK.

Q327 **Chair:** It is not in west Cumbria, is it? I don't think of it as being a clay area.

Professor Corkhill: No. West Cumbria has a volcanic kind of geology, whereas the east coast of Lincolnshire does have clay. We have a very varied geology. There are many different places where we could put a geological disposal facility. Clay is ideal. Granite is possible, which is what they are using in Finland and Sweden. You could even put it in salt; salts are where the waste is being disposed of in America, for example at the WIPP facility. There are lots of different options.

Q328 **Chair:** I can understand why community support is important, but most important is safety over 1,000 or more years. Is there a danger that we are trading off community support, where there are political difficulties in getting acceptance—small p rather than capital P—against fundamental safety, which comes from the rocks rather than whether the current people on the surface want it or not?

Professor Corkhill: A geological disposal facility must have both; it must have a willing community and a suitable site, so that is the geology. To a certain extent, there is a small amount of flexibility on the geology because when the waste is disposed of it is protected by a Russian doll system where the waste is inside a container surrounded by backfill and so on. You can design that engineered barrier to suit the host geology.

In geologies that are perhaps not so favourable that would be more expensive because you have to use more materials. It is a bit like in the Swedish and Finnish environment where they have a 5 cm thick copper container. That is expensive. They use that because there is a lot of water in their repository, whereas in France, where they build their repositories in clay, they do not have to have a thick outer container because there is not so much water. There is more flexibility in the geology because we can design the engineering and protection system to suit the geology.



HOUSE OF COMMONS

Q329 **Rebecca Long Bailey:** On the issue of nuclear fuel recycling, what are the benefits and challenges of a closed nuclear fuel cycle, Dr Taylor?

Dr Taylor: The benefits are about recovering valuable materials that can be reused to maximise the energy value of the fuel. You can minimise the call on natural uranium resources. It gives us a degree of energy independence and security because we have a supply of that material. It is also more sustainable. In life cycle analysis, it has been shown that it reduces the environmental footprint of nuclear. If you recycle materials other than uranium and plutonium, you can start to reduce the waste burden on the repository. That could have impacts on the volume of waste and its longevity in the repository, and even the size of that repository.

Q330 **Rebecca Long Bailey:** Do you think there is a need to maintain closed cycle in the UK, especially if new reactor technologies are deployed?

Dr Taylor: We do not know how society will change over the next 50, 60 or 80 years when these reactors will be operating. We know we can safely and securely store and dispose of these materials. Some of the reactors, particularly advanced modular reactors, will have different fuels. There is confidence that they can be disposed of, but it might not be the optimum route that future generations want to take. We need to keep that option available, at least at the research and development level of investment, to make sure that we understand it or that we develop new technologies that can provide innovation and reduce costs and impacts, so that future generations have that choice and reduce the risk; we have just heard some of the risks with repositories. We need a mitigation approach as well, so it is sensible to hedge our bets and keep that option available.

Q331 **Rebecca Long Bailey:** Professor Morris, is there anything you would like to add?

Professor Morris: No, but I have a general reflection. It is the general point that we are assuming that all the skills, capabilities and capacity will be present to achieve these variable GDFs, interim storage and recycling. There is a clear role for skills development and capacity building in order to achieve all the programmes that this Committee is considering.

Q332 **Rebecca Long Bailey:** Where do you think we are at in the UK in our skills capacity at the moment?

Professor Morris: I think it needs to grow.

Q333 **Rebecca Long Bailey:** What would you like to see the Government do to address that issue?

Professor Morris: Have stability around programmes. We could go to a granular level, but it is the general vision around the programmes that we need to be achieved. When I talk to my students and others, I hear that a career in decommissioning and waste management is felt to be quite negative, but when you engage people in these conversations there



HOUSE OF COMMONS

is quite an excitement about this area and across new nuclear, so perhaps that is not as much of a challenge. It is about stability and clarity around programmes, which I think is being achieved.

Q334 Rebecca Long Bailey: We have heard previously in this Committee that the conversion step for reprocessing uranium can be done only in Russia. What is needed for the nuclear fuel industry to carry out this conversion step elsewhere, Dr Taylor?

Dr Taylor: Really, that would be a good question for Urenco would be how we build that domestic capability. There are additional challenges in converting to uranium hexafluoride, the reprocessed uranium, but we have large stocks of reprocessed uranium that can be recycled some was in fact from the Magnox cycle. Some of the additional contaminants in the reprocessed uranium make it more challenging to do that conversion stage. It was encouraging to hear the evidence from Urenco that they could do the re-enrichment once they had that step. How you build the domestic capability for that is a good question.

Q335 Rebecca Long Bailey: Professor Morris and Professor Corkhill, would you like to add to that?

Professor Corkhill: On uranium, my committee has recently performed a piece of work on behalf of BEIS to understand options for our stockpile of depleted low-enriched and natural uranium. There are 180,000 cubic metres of this material. That is 17% of the higher-activity waste inventory for a geological disposal facility, and it is unique in terms of its characteristics. In most radioactive waste, its radioactivity reduces with time in a repository, but with this material, the DNLEU, because of the in-growth of daughter products it increases, so from a geological disposal perspective it is kind of tricky from a safety case point of view. While it is disposable in a geological disposal facility, it will be interesting to understand whether other options could make use of that material.

Q336 Graham Stringer: If I could follow up the Chair's question about disposal to Professor Corkhill, what are we securing the nuclear waste against? Is it geological disturbance or theft by potential terrorists? What threat are we securing against?

Professor Corkhill: It is against the contact of future populations with the high radioactivity in the radioactive waste. That is the primary goal.

Q337 Graham Stringer: I understand that, but is it because of likely geological disturbance or because one fears, not unreasonably, that people might pinch the stuff and use it in a dirty bomb?

Professor Corkhill: While the waste at present is in safe and secure storage, as we discussed earlier, and it can be until the geological disposal facility is available, this is an inter-generational issue. There is a moral and ethical underpinning. I am a grandchild of the people who first made nuclear power work. I am already having to work to deal with this. Should my grandchildren have to look after it as well?



HOUSE OF COMMONS

One of the reasons why geological disposal is necessary, as Kath said, is that we do not know what future populations will be. I would even go as far as to say civilisations. Those are the timescales we are talking about. You only have to look at the current situation in Ukraine at the Zaporizhzhia nuclear power station where nuclear waste is being stored at the surface. I am not sure that when that power station was built they ever envisaged that there would be missiles flying over that waste store. You cannot envisage today what might be happening 200 years in the future. Is it ethically right for us to leave that for future generations to deal with?

A second very important point is that it is expensive to keep repackaging. After a certain period of time, those wastes may need to be repackaged. You have to build a new plant and train a skilled workforce just to maintain that waste in a way that is safe and secure at the surface. The most efficient and safest way to deal with this material is to put it out of reach, and the best available option, as we see it, is geological disposal.

Q338 Graham Stringer: I don't want to put words into your mouth, but you are looking for total security against any possible leak or movement of the material, whether it is human beings, bombs or geological effects.

Professor Corkhill: Or climate change: sea level rises, glaciation and those kinds of things.

Q339 Graham Stringer: It is a sort of universal protection.

Professor Corkhill: Yes.

Q340 Chair: Professor Morris?

Professor Morris: To augment what Claire said, you do not consider one thing—you consider a range of futures, events and processes that may impact on the waste. I think your question started with whether it was this or that thing, but the safety case has to consider a range of features, events and processes.

Q341 Chair: If things are stored on the surface, they are quite accessible to deal with any problems that arise. Once they are underground it is much more difficult. Were there to be any geological perturbations that crushed even the toughest containment, that would be pretty difficult to deal with, wouldn't it? Can we be absolutely certain that the possibility of geological changes, once they are consigned underground, can basically be counted as zero?

Professor Corkhill: Precisely. If the right geology is chosen, that is correct. That will be taken into consideration when you select the site.

Chair: That concludes our questions. Thank you very much indeed. We have had a very interesting and important session of evidence this morning. I thank Professor Morris, Dr Taylor and Professor Corkhill for their evidence today. Thank you for coming to us early in person.

Examination of witnesses

Witnesses: Janne Mokka and Claes Thegerström.

Q342 **Chair:** Our next panel of witnesses is appearing virtually from overseas. Joining us online, we have Janne Mokka, president and chief executive of Posiva Oy, the expert organisation responsible for the final disposal of spent nuclear fuel in Finland. We heard about the development of the facility in Finland in our earlier session. Also joining us is Claes Thegerström, former president of the Swedish Nuclear Fuel and Waste Management Company. Gentlemen, we are very grateful to both of you for joining us today.

Mr Mokka, could you describe the geological disposal facility in Finland and the challenges you experienced in getting to the point where you are now? I will then put the same question to our Swedish witness.

Janne Mokka: Hello, everyone. I was listening to the previous presentations. You ask about the status of these projects. If I start a little further back, in the early 1980s in Finland it was decided that the generation that was taking advantage of nuclear energy would take care of the waste. We were asked to select a site in about 1993 and we applied for a construction licence in about 2010. We started final disposal in about 2020. That was the plan between the Government and the nuclear facilities. Then the preparations started. Basically, we proceeded according to that plan. In the 1990s, it was more about site selection and in 2000 it was decided that Eurajoki was the municipality where we would do the final disposal. Under the Finnish licensing process, there was a decision in principle. It was a Government decision that was ratified by Parliament. It was the biggest ever done by the commonwealth of the country, and it was decided in 2003.

We applied for a construction licence in 2012, and we got it in 2015. Now we are constructing the final disposal facility. Basically, there is an encapsulation plant above ground and a final disposal facility below ground. The final disposal facility to a level of 450 metres was started in 2004. The parts which are needed for the nuclear operation started after the construction licence in 2015.

The construction work on the encapsulation plant is starting to be ready, and the manufacturing process for all the equipment needed to handle the fuel is ongoing around Europe and around the world. Some of it is already there; we are installing the equipment. It is important to understand that there is no nuclear power plant. It is handling dangerous material; it is a material-handling facility.

Basically, the equipment is being installed and there is commissioning below the ground. The excavation works in the first phase will be five final disposal tunnels. Altogether, we will have about 100. First, we excavated five. They are done and we are installing all the high-spec systems and electrical systems below ground. Things are proceeding.



HOUSE OF COMMONS

What is also important are the other components needed in the final disposal—the copper canisters and all the bentonite that is needed. The supply process for the components in the final disposal phase is ongoing. We needed a new factory to be built to make the right kind of bentonite. That is being commissioned. Those kinds of things are in preparation. One important issue is the last licensing step. We applied for an operational licence a year ago, at the end of 2021, and now the Finnish safety authority is reviewing the operating licence, and we will update it. We did the safety case part last year, and we will update it for the construction information and the final safety analysis next year.

Q343 **Chair:** You have clearly described a complex and long process. Could you very briefly say what have been the most difficult parts of it?

Janne Mokka: It is the long time period. We started in the 1980s and now we are in 2022. There have been at least two, or even more, decision makers at the political level and in the municipality and at the decision-making level at Posiva and our owners, who are financing the final disposal. You need a clear strategy and a common target for these things, because there is a new generation coming over time. You need to follow the plan.

Q344 **Chair:** Let me turn to Mr Thegerström. Perhaps you would answer the same question. Would you describe what is being done in Sweden and where you have got to?

Claes Thegerström: It is a pleasure to have the opportunity to speak to the Committee. I will try briefly to explain the Swedish process, starting in the 1970s and 1980s when Sweden established 12 nuclear reactors. You might know that we had a very hard debate about nuclear energy. We had a referendum in 1980 and waste was a key issue in that debate.

The result of that was a very strict law saying that the producers of the waste had to do everything needed to find a safe solution. Through SKB, the owners of reactors started the nuclear waste disposal programme. Early on, that programme established a repository for low-level waste underground and started the planning of the KBS concept involving copper canisters, as described by my Finnish colleague. That was presented in 1984 for international review. The Swedish Government agreed that it could be a safe solution. That decision enabled the utilities to start the last reactors waiting to get started, pending a decision on the possibility of finding a safe solution for the waste. At the same time, there was a geological investigative programme in several parts of the country, mainly to get data on Swedish bedrock.

The organised process for finding a safe site started at the beginning of the 1990s with an extensive plan and feasibility studies, where we interacted with certain municipalities, more or less like in the UK today. We worked in co-operation with interested municipalities and got them engaged in the work. In total, we worked with eight municipalities between 1993 and 2001. In 2001, based on assessment of the studies,



HOUSE OF COMMONS

we selected two particular sites for more in-depth investigations, with boreholes and investigation of the environment, land transportation and so on. This is more or less similar to what is being planned now in the UK.

Investigations went on at two sites, Oskarshamn to the south and Askersund to the north of Stockholm, between 2002 and 2009. In 2009, we made an evaluation of all the data; we made a safety report and announced the selection of the site in Östhammar at Forsmark. Two years later, in 2011, SKB presented its licence application according to two major laws: the Environmental Protection Act and the Nuclear Activities Act. The utilities' position is that those two Acts complicate licensing under the Swedish legal system a little bit, because they partly overlap. That is one of the reasons why it took from 2011 until 2022, more than 10 years, to have all the decisions needed.

Quite early we got the green light from the safety authorities. As was mentioned in the earlier session, we had some questions from the environment court where we had to come back. The Government that had to make the final decision had a Minister of the Environment who I think I can say was not very pro-nuclear. The licensing review was in a waiting position for several years, but finally in 2022 we got a decision from the Government. I am no longer with SKB; I left in 2012. Now it is planning to get the additional agreements that are needed, but they are more formal. Later on, it will start construction and can probably start operating the repository in the mid-2030s.

Chair: Thank you both very much indeed. That was very comprehensive.

Q345 **Aaron Bell:** If I could continue with Mr Thegerström first—I will put the same question to both witnesses—can you set out how your facility has been funded throughout, what challenges you have had in getting funding, and the mixture of public and private funding that has been required?

Claes Thegerström: At the same time as the Nuclear Activities Act was launched, there was an Act on the financing of the final repository. That Act was very clear in saying that the producer of the waste has to pay the cost, so a mechanism was installed whereby the utilities producing electricity with the help of nuclear power had to take part of what they gained from that and put it into what was called a nuclear waste fund. A lot of the money was funded in advance, and SKB could get its funding and yearly budgets from that nuclear waste fund. That was a key mechanism in the Swedish programme because it provided financial stability over all the long periods of implementation.

Q346 **Aaron Bell:** Is that funding sufficient not just for the construction but into the future as well?

Claes Thegerström: Absolutely. It is based on a plan that has to be presented every three years and is reviewed by authorities and so on,



HOUSE OF COMMONS

and everybody can comment on it. It should cover all costs: final disposal, construction of the needed facilities, decommissioning of all the reactors in the future and taking care of all the waste. A comprehensive set of cost items is included in that plan.

Q347 Aaron Bell: Thank you. Mr Mokka, the same question to you: how has your company been funded to construct the GDF in Finland?

Janne Mokka: It is much the same as in Sweden. In Finland too, the utilities are responsible for final disposal. We have two utilities, Fortum and TVO. Then there is the nuclear waste fund. The electricity price of the producers has been altered by a certain amount for spent fuel final disposal, and it has been put in the fund, which is operated by the Government. Basically, we make a bigger estimate every three years, but it is estimated on a yearly basis. We give a cost estimate for the construction, the final disposal operations and the closure, and the fund amount that is needed is defined and the utilities have to put in more money. We get the funding from the utilities. The fund is between the Government and the utilities. Posiva is a joint venture company of Fortum and TVO for doing the final disposal.

Q348 Aaron Bell: Have you had to borrow money as well for the construction, which will be paid back over time as fuel is put into the facility?

Janne Mokka: Yes, there must be enough money. Of course, if we want to develop a new kind of canister or something, we will ask for more money from the owners. They have terms whereby you can reduce the costs.

Q349 Aaron Bell: How does your company make a profit? Is it through the contracts to build the thing in the first place, or is it on an ongoing basis when spent fuel is deposited in the facility?

Janne Mokka: We do not make a profit. We are a joint venture company for the utilities, Fortum and TVO. Basically, they are paying our costs.

Q350 Aaron Bell: You are not intending to make a profit; you just intend to work on a non-profit basis and cover the costs.

Janne Mokka: That is how Posiva works.

Aaron Bell: Thank you very much.

Q351 Stephen Metcalfe: Good morning both of you, and thank you for joining us today. I am interested in what type of waste you plan to store in the GDFs and whether or not that has changed since you originally planned the construction. Is it all types of waste or are you going to restrict it only to high-level waste? Mr Mokka, you are on screen. Do you want to start on that?

Janne Mokka: For Posiva, it is the high-level waste coming from our owners' nuclear power plants. That is our scope. We also have reservation for the low-level waste because we are the last ones. The



HOUSE OF COMMONS

nuclear power plants have been shut down and decommissioned, and we are doing the final disposal. We have an area for decommissioning our own plants, but mainly it is high-level fuel waste from the commercial nuclear power plants.

Q352 Stephen Metcalfe: For absolute clarity, does that mean you will store the low-level and intermediate waste in the same facility, or are you going to restrict it to high-level waste? I may have misheard.

Janne Mokka: We are located in Eurajoki next to the Olkiluoto Nuclear Power Plant operated by TVO. We plan to use its low-level waste repository, let's say for the first 50 years of our operations. Then when it closes its facility, we have a reservation such that we can have our own low-level waste repository.

Q353 Stephen Metcalfe: Thank you. Mr Thegerström?

Claes Thegerström: The repository that has now been licensed in Sweden based on the KBS concept, as is being used in Finland, is only for all spent nuclear fuel from existing reactors with a planned operating time for those reactors. Regarding low-level waste, we have had a repository since the mid-1980s. It has been extended, and that is the plan for the low-level waste. For some intermediate, long-lived waste we have a plan, which will be a separate licensed process; it is not yet finally decided exactly how and when that will be implemented. That is a small amount of long-lived, low-level waste.

Q354 Stephen Metcalfe: Thank you. How are you storing the waste of all levels at the moment, prior to starting to dispose of the high-level waste in the new facility?

Claes Thegerström: Spent fuel from the reactors in Sweden is first stored at the reactor for about a year just to cool down a large portion of the heat. Then it is transported to a centralised interim storage facility at one of the reactor sites. That is where most of the spent nuclear fuel has been stored and is being stored for the moment. Some of it has been stored since the mid-1980s. That is where we will make later encapsulation in copper canisters, and those canisters will be shipped to the repository because that is at another site. Low-level waste is being stored, as I said, in the existing repository, and other waste that has not yet been disposed of is being stored at the site where it was generated.

Q355 Stephen Metcalfe: Fantastic, thank you. When you were looking at creating the GDF, did you look at alternative, perhaps intermediate depth, storage facilities for less radioactive waste, or did you go straight to the deep GDF project?

Claes Thegerström: For the material in the licence documentation, which was a big package of 10,000 pages with a lot of scientific reports behind it, we were legally required to discuss and assess at some depth different options for how that type of waste could be disposed of. For instance, deep boreholes had to be described and we had to argue why



that was not a better solution or why we did not choose that. We had to demonstrate the way we wanted to go forward and the way we wanted to do it.

Stephen Metcalfe: Great. Thank you very much indeed.

Chair: Can I thank Mr Mokka and Mr Thegerström for giving us your very valuable perspectives? As you know, this is a big current issue in the UK, and it is always good to be able to hear from those who are following the same or similar processes but in some respects are ahead of us. I am very grateful to both of you for giving evidence today. Thank you very much indeed.

Examination of witnesses

Witnesses: Clive Nixon and Corhyn Parr.

Q356 **Chair:** I now invite our final witnesses to join us virtually. We have speaking to us now Clive Nixon, who is the group chief nuclear strategy officer at the Nuclear Decommissioning Authority, the NDA, which has been referred to already; and Corhyn Parr, who is the chief executive of Nuclear Waste Services at the NDA. Nuclear Waste Services is the waste management organisation of the NDA. Corhyn Parr was previously director of integrated waste at the Nuclear Decommissioning Authority. Thank you both very indeed much for giving evidence today.

Perhaps I could start with a question to Clive Nixon. Would you comment on the evidence that we have heard, particularly on Sellafield and the difficulties that we have in storing current waste at Sellafield? In that, could you give your view on how important a geological facility might be?

Clive Nixon: Great. First, good morning, and thank you very much for the opportunity to give evidence today.

The evidence so far has been excellent in raising a number of issues. The priority for us, as many of you know, is to ensure that we reduce the risks and hazards as quickly as possible with regard to some of our intolerable facilities at Sellafield. In order to do that, we are progressing with retrievals, as Claire described, and placing waste in storage boxes pending disposal in the GDF. To do that, we need a range of stores to hold that material safely and securely, pending arrival of the GDF.

As Claire described, an integrated programme of retrievals and storage is clearly required, and if there are potential delays, or the arrival date of the GDF is not as anticipated, more stores will have to be built to maintain the pace of retrievals. I do not want to suggest that the absolute rate of retrievals is certain. There is a range of uncertainties in retrievals programmes, particularly at Sellafield, again as Claire described, because the activities that we are undertaking, frankly, are first of a kind, and there is inventory uncertainty in the activities that are we are doing.



HOUSE OF COMMONS

What we are doing with Sellafield is agilely managing the waste storage requirements with the waste retrieval programmes to ensure that we always have safe and secure storage for our packages once they are retrieved. From my perspective, we have a robust and flexible, albeit not agile, approach to dealing with the uncertainties of the decommissioning programmes alongside the uncertainties associated with GDF.

Q357 **Chair:** You heard the discussion, I am sure, about the need or the desirability for a very long-term disposal facility. Given that Sellafield has been operating for over 50 years, are you able with confidence to say that you can secure the nuclear waste that you have for another 50 years, were there to be delays in the creation of a long-term geological facility?

Clive Nixon: Assessments are done all the time, Chair, to look at that and to ensure that both the package longevity and the store longevity are understood, to take account of any potential uncertainties of GDF availability dates. I am confident in that respect.

Q358 **Chair:** Thank you very much indeed. Perhaps you could comment on this. One of the features of recent decades, or of all the decades that you and your predecessors have been in operation, is that the cost of nuclear decommissioning has increased. What has caused that? What is the driver of the sustained inflation over many decades of nuclear decommissioning costs?

Clive Nixon: When the NDA was set up, we were very much in discovery phase, to be honest, of the liability that we had inherited, and we have spent a bit of time understanding the scope of the liabilities across the estate and what the inherent uncertainties of that scope were. Since then, we have a better picture, but not a full picture, of the activities that we have to undertake to take us from where we are now to the end of our mission, so that we can release the sites for other uses. It is a tale of uncertainty, Chair.

We have now established greater certainty through experience and through doing, which gives some confidence, but the figure that we have for the liability of about £150 billion is subject to some significant uncertainties. Previously and historically, we have used ranges there, so it could be a bit less if we can drive some opportunities, but it could also be significantly more, potentially up to double the figure I quoted.

Q359 **Chair:** Do you think that we are entering a period of greater stability in terms of costs or knowability than we have experienced to date?

Clive Nixon: I would very much like to think so, but there are no guarantees in this. As I said, many of the things we are doing are first of a kind. I think there was some reflection previously that a major part of our liabilities provision is based on the historical separation activities associated with defence and early nuclear rather than reactors, which I think are the focus of this session. Yes, I think we are in a good place, but there is still significant uncertainty, as I recounted, so we cannot



guarantee what the cost will be and how long it will take; it is a multi-decade programme.

- Q360 **Chair:** Thank you. I wonder whether you might comment, Mr Nixon, on something that Professor Katherine Morris said about the workforce and having the right skills in nuclear decommissioning. She commented that it was not necessarily the most attractive career for someone to have, and new nuclear might have more excitement around it. It is obviously hugely important that you have the right skills.

The one thing we know is that industries come and go, and jobs come and go, but your task will be there beyond all of our lifetimes, so it is a career that offers certainty, one might say, that the demand for someone's services will be there for the whole of their working life. Are you able to deploy that and tell me what you are doing to make sure that you get high-quality people at every level to work in nuclear decommissioning?

Clive Nixon: It is a really good question. I am a career nuclear person. I have invested 30 years of my life in something that I believe is a very righteous cause, particularly with regard to environmental restoration. I think there is a very exciting career in decommissioning and clean-up, but, as was pointed out, we have a skills scarcity across the whole sector, in a range of activities in the nuclear sector from defence through to civil new nuclear and decommissioning, which means, I suspect, that we do not have enough people now.

We need to start to plan in a very structured way to ensure that we understand what skills we need and intervene very early on in things such as STEM activities and establishing career paths and mobility across the enterprise to ensure that we keep people interested in the sector. Working patterns have changed a lot since I started all those years ago, as you probably understand.

- Q361 **Chair:** There is a general need for more STEM skills across all of the areas that this Committee takes an interest in and has responsibility for, and nuclear as well. Is what Professor Morris said about the particular challenge for decommissioning something you have a particular strategy to deal with and to attract people in?

Clive Nixon: We are establishing the skills we need and we are looking very much across the full enterprise of decommissioning as part of that. As well as specific decommissioning skills, we need what I call nuclear leadership, people who are competent working in the nuclear field broadly but are also very strong leaders, not necessarily in purely technical workstreams, which is more of a STEM angle, and not necessarily generic leaders, but a mix of things. We could probably invest a bit more in that overall across the sector.

I am trying to make the work that we do interesting to people. I believe we are doing something that is very important for our generation and for future generations. Working through that strategy and making the NDA



an attractive place to work and a great place to work is a core mission for all of us.

Q362 **Chair:** Thank you. Corhyn Parr, as well as the responsibilities that I introduced you as having, you are the current chair of the Nuclear Skills Strategy Group. What is your perspective on getting the right skills that are needed and on which we rely for this crucial work to be done over the decades ahead?

Corhyn Parr: If we look within the decommissioning remit, as Clive says, we have a good, strong skills base in the UK. We have been doing decommissioning and waste management for many decades. The challenges help us to attract professionals in the nuclear sector who want to look for new challenges every day.

In Nuclear Waste Services, we have a very low turnover of staff. We have an excellent technical team. Because the work we are doing is first of a kind in the UK, we are able to attract the technical folk. We are challenged on the broader skillsets—commercial resources, project and programme control-type resources—and that is because we are competing against other major infrastructure programmes. Obviously, with some of the constraints that we have in the public sector that will be an issue in the next five to 10 years.

Looking across the whole of the sector, we are currently looking to recruit 3,000 new resources a year, and with the new-build programme where we are looking at up to 24 GW, that will increase to about 10,000 new resources a year across STEM and other broader subjects.

Chair: Thank you very much indeed. Let me turn to my colleagues, starting with Rebecca Long Bailey and then Stephen Metcalfe.

Q363 **Rebecca Long Bailey:** Thank you. On the issue of storage of radioactive waste, can you let the Committee know how much nuclear waste the UK currently manages? Clive, are you best placed to respond to that question?

Clive Nixon: Yes. We publish something called the radioactive waste inventory on a regular basis, which looks at the current waste in store and the projections, based on assumptions around new nuclear and the legacy. Looking forward, the totality of the inventory we are going to be dealing with is about 4.5 million cubic metres. The vast majority of that is in the lower range—the low-level waste and very low-level waste category. About 90% of it is in that area.

For GDF, which is Corhyn's area particularly, we are expecting about 775,000 cubic metres of intermediate-level waste and high-level waste. Those are large quantities, but the vast majority of the activity is in the intermediate-level waste and high-level waste—the lower volume. The high-volume stuff has significantly less radioactivity associated with it.

Q364 **Rebecca Long Bailey:** Thanks, Clive. Is 775,000 cubic metres how



HOUSE OF COMMONS

much you expect waste to increase by in the future?

Clive Nixon: That is the totality of the inventory for GDF.

Q365 **Rebecca Long Bailey:** Okay. The UK Government do not currently classify spent fuels as waste and have closed the fuel reprocessing facilities. Are spent fuels included in those figures, as far as you are aware?

Clive Nixon: Yes, as far as I am aware, there is a derived inventory that we include in that.

Q366 **Rebecca Long Bailey:** This Committee has also heard that the UK's current policy on radioactive waste management is based on a 1995 White Paper that has been updated regularly for specific policy matters. Would a truly integrated waste management policy require a completely new approach, Corhyn?

Corhyn Parr: Currently, the waste policy that we have is working, and is working for the UK. As you have heard, we are proposing to dispose of the 775,000 cubic metres of higher-activity waste in a GDF. All other waste is disposed of at the low-level waste repository in Cumbria. We have a response within the current policy on how to deal with all of our legacy and future nuclear waste up to 16 GW, and we are currently looking at what that could be for 24 GW. We understand that a policy consultation could happen in the near future, and we will respond to that policy consultation. We are looking at options for different types of disposal methods, depending on the activity in the waste.

Q367 **Rebecca Long Bailey:** Thanks, Corhyn. How can new technologies be utilised in a new waste management policy?

Corhyn Parr: We are looking at technologies all the time. We are looking at different types of waste treatment either to make the waste more passively safe or to volume-reduce the waste. For example, we are looking at thermal treatment for certain types of waste streams that we currently plan to store in preparation for a GDF. These are technologies that are utilised elsewhere across the world, and we are bringing that practice to the UK.

Q368 **Rebecca Long Bailey:** Clive, is there anything you would like to add to that?

Clive Nixon: The revisions to the policy framework are important for us to open up the landscape, and to optimise the waste management landscape that Corhyn has described, particularly looking at alternative disposal facilities and routes such as near surface disposal. It is all about putting the right waste in the right place if you have to dispose of it, ultimately.

We are actively using something called the waste management hierarchy. Disposal is the last resort in that hierarchy. Ideally, we want to avoid waste being produced, minimise it, and reuse or recycle it ahead of



HOUSE OF COMMONS

disposal. Managing that overall landscape within a revised policy framework that BEIS is hoping to consult on is really important to us to make it work.

Q369 Rebecca Long Bailey: How close is the NDA to achieving its aim of all nuclear facilities under its remit of having a digital twin or equivalent by 2025?

Clive Nixon: That is part of the grand challenges that I think you were referring to, Rebecca, as we have gone through that. We are making progress on all of them. I cannot give a specific answer to the question you have just asked, but I will give some written response if it will help.

Q370 Rebecca Long Bailey: Thank you. Finally, you mentioned near surface waste disposal. Very briefly, what are the similarities and differences between the process of implementing permanent near surface disposal in Scotland and the process of planning for a geological disposal facility, as is the English and Welsh policy?

Clive Nixon: As you have noted, the Scottish policy is different from the English and Welsh policy. The Scottish policy is planning on up to 300 years' storage with near surface disposal as a final end point, whereas we are looking at a GDF. The process that is being looked at for near surface disposal is to have a policy framework, as we have talked about, that enables that sort of activity to take place, and we are looking to make a case for going forward with near surface disposal based on the policy being available and what wastes are available for disposal from our decommissioning programmes.

Rebecca Long Bailey: Thank you.

Q371 Stephen Metcalfe: Good morning. Corhyn, at what stage is the development of the geological disposal facility? Where are we with that and what are the next stages?

Corhyn Parr: To give you an overview of the programme, we are currently in tranche 2, which is where we look at siting options and community engagement. Both of those need to work in parallel because, as you have heard previously, we need a community committed to the GDF, but with the appropriate geology in that region.

We have four communities actively engaged in the community engagement phase—three on the west coast, as you have heard, and one on the east coast. Obviously, they have different geologies, so we are working with all four of those communities to assess the geology in a variety of ways, through seismic surveys and moving on to more instructive surveys in the future. Then we will make an assessment community by community of the ability to continue forward to the next phase of the programme.

We will take that down to select two communities where it is technically feasible to build the GDF, and in about 2025 to 2026 we will advise BEIS



HOUSE OF COMMONS

on moving forward with those two communities. Then we start the process of borehole assessment to understand in more detail the geology in which we will be building a GDF, and we will continue to look at the design required that is suitable for those geologies, and most importantly the safety case. That will take approximately 15 to 22 years, and then we start the GDF construction phase in about 2040 to 2047.

Q372 Stephen Metcalfe: You think that by 2025-26 you will have a community identified that wants to work with you for this. Why is there then such a long 22-year period to design the facility, or does that include the construction, and would that be the date when the first waste was to be encased in it?

Corhyn Parr: We are looking at a first waste emplacement date in about 2050. That will be dependent on the geology. Tranche 3, which is where we do more detailed surveys and design of safety casework, is reliant on a series of development consent orders, which take time. A big proportion of the next phase is in the permissionings arena, as well as working with the communities to look at the long-term benefits of a geological disposal facility in their community.

Q373 Stephen Metcalfe: The majority of that 20-odd years you think is in terms of permissions.

Corhyn Parr: The first phase of that is permissions to look at deep boreholes. Then we have a cyclic period of safety casework and design work so that when we come to the end of tranche 3, we are, essentially, construction ready. There is also a large procurement phase within that to ensure that we have the supply chain ready to start construction in tranche 4. The 15 to 22 years is the main part of the design and being construction ready for the GDF facility build phase in 2040 to 2047.

Q374 Stephen Metcalfe: Is there a design within the organisation to try to speed that up or perhaps work with Government to try to speed that up, or is that just how long it is going to take?

Corhyn Parr: This is a very credible programme that we can stand behind. We have some great communities and some good geologies that we are looking at, so we are really confident in those dates. We are of course looking for opportunities to work within our own constraints, and with the permissioning, governance and oversight that is required for a programme at this stage, to see if we can accelerate any of those decision timescales.

Q375 Stephen Metcalfe: Excellent, thank you. Can you give us an idea about the cost of the GDF and how it is proposed to finance that?

Corhyn Parr: Currently, we are looking at a cost range of about £20 billion to £50 billion. That includes the full inventory up to 16 GW of new build. That is our current policy. We will obviously look at that if it changes. Of that, legacy waste is approximately £12 billion to £32 billion. That includes all of the NDA waste as well as MOD waste and some of the



HOUSE OF COMMONS

current operating sites' spent fuel waste and intermediate-level waste. Between £10 billion and £30 billion is currently funded by HMG through the NDA and MOD funding, and a proportion comes from the Nuclear Liabilities Fund as set up for the operating reactors.

Future funds will be allocated for new build as required in the new-build programmes and will essentially be set aside as those programmes develop. All the funding has been identified through NDA and MOD or the Nuclear Liabilities Fund or future decommissioning funds.

Q376 Stephen Metcalfe: Great, thank you. Obviously, it is a huge programme, it is expensive, it is going to take a long time to develop, and there will be some technical challenges, I am sure, along the way. What do you need from Government to make it happen, and are you getting it?

Corhyn Parr: At this early phase, it is consistency of policy, which we have. That has helped us to accelerate the programme in the last three to four years more than we have in the last decade. We are really pleased with the policy cover that we have. It is also about consistency in funding. We are currently spending about £100 million a year on the GDF, and that is due to increase over the coming years, especially when we get into tranche 3. We recognise that there is a difficult funding position for the whole of the public sector, but this programme cannot be delayed, and we do not want to give the communities, or our supply chain, any issues due to funding constraints. Long-term funding would be beneficial, especially as we move into tranche 3 of the programme, as well as long-term support for the GDF facility.

I started in this sector 25 years ago, and we were about 25 years away from a GDF. There are a lot of us who really want to see this programme come to fruition. Because we have made such gains now, it is about developing public acceptance, talking publicly about the benefits of the GDF, and really getting behind it.

Q377 Stephen Metcalfe: Excellent. It is progressing well. Hopefully, we will see it come to fruition. Is there anything that we can learn from other countries about site selection, speeding up the process, and how we can make it become a reality as soon as possible?

Corhyn Parr: There is a fantastic international community in geological disposal. You heard from two witnesses recently. We gain a huge amount from the international geological disposal communities. We work very closely with Finland, Sweden and France specifically. We are able to gain a huge amount of technical know-how and expertise from their underground test facilities. We have regular visits and sharing of not just the technical aspects of creating and developing a design and safety case, but waste packaging, waste emplacement and community engagement.



HOUSE OF COMMONS

We have learnt a huge amount from the French programme around education in local communities and developing and leaving behind longer-term benefits for those communities. We have already built a lot of that best practice into the GDF programme, which is why we are confident in the plans we have. The community is essential. What we are dealing with here in the UK is to accelerate, as I said, our planning regime and our permissioning regime. We are making sure that we look at the benefits and best practice we can put in place there.

Q378 Stephen Metcalfe: Do you think that site selection is progressing as rapidly as it can against the constraints that you have within the current framework? As an adjunct to that, is the selection of the site influenced at all by the need to transport material to the GDF?

Corhyn Parr: That is a great question. The east coast site that we are looking at is a non-nuclear community and would require the transport of material to the facility for disposal. We transport radioactive material all the time in the UK. We are very good at it. We will be building into the total cost and duration of the GDF all of the transport requirements to put the waste in the facility. That will be part of our recommendation to BEIS in 2025-26 around site suitability. It will be baked into the overall cost and operation.

Q379 Stephen Metcalfe: Excellent. I have one final question. This is obviously a very long-term project. Will it ever have an end period, or will it continue to expand? Once you have selected a community, will it expand as the need for waste disposal expands over decades and, therefore, potentially centuries?

Corhyn Parr: Yes, absolutely. We are looking at a first waste emplacement date of 2050, but we will also look at a modular build for that facility, and we will be assessing the vicinity of the GDF to allow for that expansion. To put that into context, if we look at all of our legacy waste, we are talking about a 20 square kilometre area for the repository. When we add 16 GW, that goes up to 24, so you can see that the majority of the area that we need is for our legacy waste. If we were to increase to 24 GW, it goes up by another 4 square kilometres.

The longer need for a GDF for delivering disposal for new build and general energy creation is not the same as the legacy waste volumes that we have to deal with, and should deal with, in a permanent way. We will obviously look at the opportunities for expansion. We do not consider that an additional repository will be required, certainly for the next 100 years of energy generation.

Stephen Metcalfe: Okay, great. Thank you very much indeed.

Q380 Chair: Thank you, Stephen, and thank you, Corhyn Parr, for your clarity. I have one last question for Clive Nixon, if I may, which goes back to some discussions we had at the beginning of our hearing on the interim storage of intermediate-level waste. How can we reduce the costs of that



HOUSE OF COMMONS

before permanent GDF storage is available?

Clive Nixon: One of the key things we are doing is looking at where we have to build stores, trying to make them repeatable and trying to use historical designs and so on, to ensure that the cost of storage is cheaper as we go forward. We are also looking at things such as containers for holding waste and making sure that we procure those appropriately, driving the supply chain to deliver economies against those activities.

Q381 **Chair:** Do you think it can be cheaper than it is now?

Clive Nixon: Pardon me?

Q382 **Chair:** Do you think it can and will be cheaper in future than it is now?

Clive Nixon: Through replication—this is a general point—and standardisation, I believe there are economies to be made.

Q383 **Chair:** Is that enough to counteract the general increase in inflation that we are seeing in most things, not least in—

Clive Nixon: It is hard to say at the moment. If I could predict that, I would probably not be doing this job.

Chair: All right. We are grateful for your evidence, Clive Nixon and Corhyn Parr, and for your once again helping the Committee with this inquiry. Thank you for your evidence today. That concludes our questions on nuclear for today.

I end by wishing a merry Christmas to our excellent team who support us in these sessions, including our colleagues who help broadcast our proceedings to the public and the Hansard team who transcribe our sessions so that we can make use of them and other people can as well.

Since this is the last session at which the Committee's Clerk, Danielle Nash, will be with us before, very sadly for us, transferring to another Committee—very good news for them—I thank Danielle on behalf of the Committee for all the wonderful work that she has done in serving the Committee so well, including through some very important and quite intense sessions that we had on covid. They were demanding for everyone, but Danielle bore it and did a very important piece of public service in making sure that this Committee was able to ask the key questions of the key decision makers through that. We thank Danielle and wish her well in her next Committee. That concludes this meeting of the Committee.