

Oxide Fuels

Preferred Option

June 2012

Executive Summary

Our Strategic Position on Oxide Fuels

After the NDA was formed it inherited a range of contracts covering reprocessing and storage of oxide spent fuels in the THORP facilities.

In November 2011, with the publication of our Credible Options paper, we set out our options for oxide fuels and our assessment of them against a number of criteria. Our analysis showed that the amount of spent fuel that should be reprocessed in THORP on economic grounds is comparable to the amount that is contracted to be reprocessed.

Based on this we concluded that the delivery of the current strategy – to reprocess the contracted amount of spent fuel in THORP – remained the most viable and cost-effective option and called this our strategic position.

Confirmation of this strategic position as our Preferred Option for oxide fuels depended on meeting two key conditions.

- a. Securing an agreed means for the interim storage of the remaining AGR spent fuel, and any future arisings
- b. Demonstrating that the reprocessing contracts can be completed without the replacement-HASTs.[1]

Confirmation of our Strategic Position

Since we published our strategic position we have continued with our work to secure these two conditions (see Section 3). We have considered new information on the performance of our existing and planned-for assets to support reprocessing (see Section 4), and also new information from EDF Energy on its plans to extend the lifetimes of its AGR power stations (see Section 5). We have also considered the stakeholder responses we received on our Credible Options paper (see Section 6).

After considering and assessing all of this information we have now confirmed our strategic position as our Preferred Option for oxide fuels, which is that:

- Completing the reprocessing contracts in THORP remains a viable and cost-effective strategy and,[2]

[1] The HASTs are Highly Active Storage Tanks used to manage some of the liquors coming from reprocessing operations. There is an existing fleet of HASTs. Sellafield Ltd have been running a project to determine whether the existing fleet has sufficient capacity to complete the reprocessing programmes or whether replacement-HASTs are required, see Section 3 for further details.

- We plan to place the remaining AGR fuel, including any future arisings, into interim storage pending a decision to dispose to a GDF.

There are, however, a number of performance risks that could impact on the delivery of the strategy. In some scenarios operational difficulties could result in the reprocessing of less than the currently planned amount of spent fuel by late 2018, the date by when reprocessing in THORP is expected to be completed. We believe, therefore, we should continue to examine alternative options so that we can manage these risks to the delivery of our strategy.

The Management of Oxide Fuel Beyond the Closure of THORP in 2018

After the closure of THORP, our plans for the remaining AGR spent fuel are to interim store it pending packaging for disposal in a GDF, which is expected to start in 2075. The NDA is still many years from making final decisions on the design of the disposal concept and the facility in which the spent fuel would be emplaced (ie the GDF).

We will continue, therefore, our work with Sellafield Ltd and RWMD to ensure we are able to manage our Oxide fuels through to disposal.

We expect to provide periodic updates on our progress with the interim storage and disposal of AGR spent fuel including any new strategic decisions, if any, that may arise.

In addition, we will review the progress and health of our strategy for oxide fuels on an annual basis.

[2] To complete the reprocessing contracts some flexibility will be required around some small amounts of fuels. This amounts to a small fraction, <0.5%, of the THORP order book by mass.

EXECUTIVE SUMMARY	2
GLOSSARY	5
1 BACKGROUND	6
2 MEETING OUR TWO KEY CONDITIONS	7
THE INTERIM STORAGE OF AGR SPENT FUEL	7
THE NEED FOR REPLACEMENT HASTS	8
3 THE IMPACT OF PERFORMANCE RISKS ON THE DELIVERY OF OUR STRATEGY	9
4 OUR ABILITY TO MANAGE THE LIFETIME ARISING OF AGR SPENT FUEL	10
5 SUMMARY OF STAKEHOLDER RESPONSES TO OUR CREDIBLE OPTIONS PAPER	11
6 OUR PLANS FOR MANAGING OXIDE FUEL BEYOND THE CLOSURE OF THORP IN 2018	12
7 CONFIRMATION OF OUR STRATEGIC POSITION ON OXIDE FUELS	14
APPENDIX A: A SUMMARY OF THE INVENTORY, OWNERSHIP AND CONTRACTS OF OUR OXIDE SPENT FUELS	14
APPENDIX B: CREDIBLE OPTIONS SUMMARY – REPRODUCED FROM REFERENCE [4]	17

GLOSSARY

AGR	Advanced Gas Cooled Reactor. There are seven AGR power stations in the UK
BNFL	British Nuclear Fuels Ltd, the previous owner and operator of Sellafield Ltd prior to the formation of NDA
EDF Energy	The company that owns and operates the AGR power stations in the UK
EA	The Environment Agency of England and Wales which regulates how nuclear sites manage and dispose of radioactive and other waste
GDF	Geological Disposal Facility, a facility for the disposal of intermediate and high level wastes including spent fuel.
HAL	Highly Active Liquor, an effluent from reprocessing spent fuel in THORP that is vitrified to form a disposable waste
HASTs	Highly Active Storage Tanks, highly engineered tanks used to store HAL prior to its vitrification
HLW	High Level Waste, being ILW but of such high radioactivity content as to be self-heat generating
ILW	Intermediate Level Waste
LLW	Low Level Waste
LWR	Light Water Reactor (comprising PWR (pressurised water reactor) and BWR (boiling water reactor designs)
MOX	Mixed Oxide Fuel, comprising plutonium and uranium oxides
NDA	The Nuclear Decommissioning Authority
NMP	Nuclear Management Partners, the operator contracted by the NDA to run Sellafield
ONR	The Office for Nuclear Regulation is responsible for all nuclear sector regulation across the UK
OSPAR	Oslo Paris Convention on protecting the marine environment of the North East Atlantic
PWR	Pressurised Water Reactor. Sizewell B is a PWR
RWMD	Radioactive Waste Management Directorate. A division of the NDA responsible for developing a GDF for the disposal of intermediate and high level wastes including spent fuel
SL	Sellafield Limited
SF	Spent Fuel
THORP	Thermal Oxide Reprocessing Plant – a chemical plant owned by NDA and operated by Sellafield Ltd for the reprocessing of oxide spent fuels from AGRs and LWRs
UKAEA	United Kingdom Atomic Energy Authority

1 BACKGROUND

1.1 After the NDA was formed it inherited a range of contracts covering reprocessing and storage of oxide spent fuels in the THORP facilities.[3] The NDA was directed by the Energy Act 2004 to operate THORP to complete the reprocessing contracts for both overseas and domestic customers.

1.2 At that time THORP was expected to complete the reprocessing contracts by 2010. However, due to operational difficulties both in THORP and in downstream support plants, this has not been possible. THORP is now expected to complete the reprocessing contracts in 2018.

1.3 In accordance with the commitment given in our 2011 Strategy, the NDA has been investigating whether the current strategy for managing our oxide fuels, compared to other credible alternatives, remains the most cost-effective.

1.4 In November 2011, with the publication of our Credible Options paper, we set out our options for oxide fuels and our assessment of them against a number of criteria.[4] These criteria include safety, security, environmental, cost and socio-economic factors, as well as our contractual commitments and alignment with Government policy.

1.5 We explained that in our view the key questions facing NDA are how much of the oxide fuel inventory should be reprocessed in THORP and how any remaining fuels should be managed after its closure.

1.6 In the study we compared three options based on the amount of spent fuel reprocessed.

- **Option 1:** Complete the reprocessing contracts in THORP — the current strategy
- **Option 2:** Reprocess less than the contracted amount of spent fuel in THORP
- **Option 3:** Reprocess more than the contracted amount of spent fuel in THORP.

1.7 The detail of the options development, analysis and arguments are presented in the Credible Options paper and are not reproduced here.[5]

[3] A summary the inventory of Oxide fuels, the ownership of them and the contracts that cover them is provided in Appendix A of this paper

[4] <http://www.nda.gov.uk/documents/upload/Oxide-Fuels-Credible-Options-November-2011.pdf> .

[5] For reference the Executive Summary of the Credible Options is provided in Appendix B of this paper.

- 1.8 Our analysis showed that the amount of spent fuel that should be reprocessed in THORP on economic grounds is comparable to the amount that is contracted to be reprocessed. This is due to a number of interacting factors which results in an alignment of economic and commercial drivers.
- 1.9 *We concluded that the delivery of the current strategy (Option 1), remains the most viable and cost-effective option and called this our strategic position.*
- 1.10 Confirmation of this strategic position as our Preferred Option for oxide fuels depended on meeting two key conditions;
- a. Securing an agreed means for the interim storage of the remaining AGR spent fuel, and any future arisings
 - b. Demonstrating that the reprocessing contracts can be completed without the replacement-HASTs.[1]
- 1.11 We committed to continue our work to underpin our strategy and to publish our Preferred Option when we had completed this work, which we expected to be by summer 2012.
- 1.12 Through the Credible Options paper we invited feedback on our strategic position and this business decision on THORP and the management of AGR spent fuel.

2 MEETING OUR TWO KEY CONDITIONS

THE INTERIM STORAGE OF AGR SPENT FUEL

- 2.1 Sellafield Ltd has undertaken options studies and technical assessments to select the best *interim storage* method to manage AGR spent fuel following the closure of THORP. The outcome of these assessments has concluded that wet storage in the THORP pond [6] is the best available technique from both a technical and environmental standpoint.
- 2.2 AGR spent fuel is currently *buffer stored* in ponds at Sellafield and will typically spend less than ten years in storage prior to reprocessing.[7] By *interim storage* we mean that the spent fuel will be placed into a storage regime in which we have high confidence that it can be safely managed for

[6] The THORP pond is commonly referred to as THORP Receipt and Storage (TR&S).

[7] We have AGR spent fuel that has been stored in ponds at Sellafield for over twenty years. Sellafield Ltd intends to undertake a detailed examination of this AGR spent fuel to support their work on the development of a safety case for interim storage.

the foreseeable future, at least twenty five years and possibly as long as one hundred years.[8] We have chosen pond storage as this approach is strongly aligned with our current plans to store the AGR spent fuel until 2075 and then dispose of it to a GDF. However, our approach to interim storage would also allow a transition to a different storage regime, such as dry storage, and would also not foreclose the option to reprocess the spent fuel at some point in the future, if future Government policy required it, or the economics of spent fuel recycling justified it.

2.3 Sellafield Ltd has continued its work to develop the approach for the basis of a safety case for the *interim storage* of AGR spent fuel. This approach sets out the key safety principles that will be met and the technical basis for achieving this. It is based on the considerable operational experience and a technical knowledge base which Sellafield Ltd has accumulated from over 30 years of successfully managing AGR spent fuel. This work culminated earlier this year when the approach was shared with and noted by Regulators and also formally noted and endorsed by the Sellafield Ltd Board.[9]

2.4 In due course a formal safety case for the *interim storage* of AGR spent fuel will be submitted to the Regulatory Authorities (ONR and EA). Prior to this, Sellafield Ltd will also apply to the local authority for the necessary planning permission to support this approach. Based on current plans, we expect Sellafield Ltd to submit its planning application sometime around 2016 and there will be significant engagement with the local authority in advance of this.

THE NEED FOR REPLACEMENT HASTS

2.5 Some of the downstream support facilities used for managing the highly active (HA) effluents that come from THORP reprocessing operations at Sellafield are the Highly Active Storage Tanks (HASTs).

2.6 Over the past few years Sellafield Ltd has been running a project to determine whether additional HAST storage capacity is required to complete the reprocessing contracts. This has involved reviewing the capability of the

[8] In 2011 we undertook an independent peer-review of Sellafield Ltd's assessment of the options for interim storage of AGR spent fuel. This peer-review confirmed that wet storage in the THORP pond is the best available technique to interim store any remaining spent fuel following the closure of THORP. The peer-review also recommended further work to establish the best available technique for the long-term storage of AGR fuel until 2075.

[9] The basis of the safety case also covers the storage of small amounts of fuels and materials that may be left over following completion of the reprocessing programme in THORP. Some of the experimental Oxide fuels have enrichment levels that may prevent them from being reprocessed in THORP on technical grounds.

existing fleet and its margins of safety to manage Highly Active Liquor. In addition, the engineering design of potential replacement-HASTs was taken to a sufficiently detailed point to determine the costs, timescales and resources required to undertake the project. This supported studies to determine what benefit the replacement-HASTs could offer and on what timescales against completing the reprocessing programmes.

2.7 Sellafield Ltd have determined that there are significant margins of safety and contingency with the current fleet of HASTs to complete the remaining reprocessing programmes. Sellafield Ltd's studies have concluded, therefore, that the replacement-HASTs are *not* required for reasons of safety as they provide no increased safety benefit for the duration of the reprocessing programmes.

2.8 To reach this conclusion Sellafield Ltd has undertaken a major programme of technical and safety case support work that has involved extensive regulator engagement over the past two years.

3 THE IMPACT OF PERFORMANCE RISKS ON THE DELIVERY OF OUR STRATEGY

3.1 In our Credible Options paper we explained that some of the assets that support oxide reprocessing at Sellafield have reduced operational capability as they are ageing. For example, the availability of evaporators to support reprocessing operations in THORP is limited, until a new evaporator can be built or the capability of the current evaporators is improved.

3.2 We went on to explain that, as the delivery of the strategy carries a number of risks associated with the performance of key plants, we believe we should also continue to examine alternative options to complete reprocessing in advance of the order book.

3.3 Further evaporative capacity is being built at Sellafield to support clean-up and decommissioning of the site and the completion of the reprocessing programmes. Since publishing our assessment last year the costs have risen and the schedule slipped for the new Evaporator D.[10] We have considered whether this has a material impact on our strategy for oxide fuels.

[10] Since its original inception the scope of Evaporator D has been increased to remove the need for further evaporators that would have supported clean-up and decommissioning, a decision that will provide significant future cost savings. Our current evaporators do not have the capability to support the post operational clean out of the facilities that have managed Highly Active Liquors coming from over fifty years of reprocessing operations. Evaporator D is, therefore, primarily needed to support the clean-up and

- 3.4 Sellafield Ltd is working to optimise and improve the remnant life of our existing evaporators. Based on recent work we are confident that there is sufficient evaporative capacity from the existing and planned-for evaporative capacity to complete the overseas reprocessing contracts. However, if the schedule for the new Evaporator D slips further then it is possible we may have reprocessed less AGR spent fuel by 2018 than we currently intend.
- 3.5 Our strategy for managing AGR spent fuel is, however, robust to these potential impacts. We believe that even under these circumstances we will have reprocessed sufficient AGR spent fuel to avoid building further interim spent fuel storage capacity. Throughputs in THORP are now at the rates required to complete the reprocessing contracts in accordance with our current strategy and the Sellafield “Performance Plan”, and have been so now for the past few years.[11]
- 3.6 Risks remain with the sustained performance of THORP and support plants over the next six years. We will continue to monitor implementation of, and risks to, the strategy and develop appropriate options and plans to mitigate these risks. We are working closely with Sellafield and key stakeholders to these ends and the outcome of this work will be shared with Regulators.

4 OUR ABILITY TO MANAGE THE LIFETIME ARISING OF AGR SPENT FUEL

- 4.1 In our Credible Options paper we provided our assessment of the capacity to store AGR spent fuel at Sellafield in the event that EDF Energy extends the lifetime of its stations.
- 4.2 EDF Energy had previously announced its strategic target of securing plant life extensions by an average of five years for the AGR fleet.
- 4.3 In February 2012, EDF Energy provided an update on its strategy for life extensions to the AGR power stations and concluded that they now expect an average life extension of seven years across the fleet.[12]

decommissioning of the Sellafield site. Without it we would have to reserve capacity in our existing evaporators for clean-up operations with no guarantee that these evaporators could complete this mission.

[11] The Sellafield Performance Plan, <http://www.sellafieldsites.com/publications/sellafieldplan/>

[12] “EDF Energy’s strategy is to seek life extensions for all its nuclear power stations where it is safe and commercially viable to do so and has implemented a Lifetime Programme to underpin this. EDF Energy has previously announced its strategic target of securing plant life extensions by an average of five years for the AGR fleet. EDF Energy has completed a further technical review of the potential life limiting plant areas. Subject to the necessary formal reviews and approvals in due course, EDF Energy is now expecting an

- 4.4 If the reprocessing contracts are completed then we will have sufficient capacity to interim store in the THORP pond all the spent fuel coming from the AGR power stations if EDF Energy extends the AGR fleet by an average of seven years. We will also have sufficient capacity to interim store AGR spent fuel if EDF Energy were to further extend the life extensions of their fleet by a further few more years beyond this seven year declaration. This means we are confident we will have sufficient capacity to store all the AGR spent fuel in a single storage facility even if EDF Energy achieves lifetime extensions beyond their current best estimate.
- 4.5 The NDA will continue to work closely with EDF Energy and Sellafield Ltd to understand the impacts of potential station extensions on our ability to receive and manage the lifetime arisings of AGR spent fuel at Sellafield.

5 SUMMARY OF STAKEHOLDER RESPONSES TO OUR CREDIBLE OPTIONS PAPER

- 5.1 Through the Credible Options paper we invited feedback on our business decisions about THORP and AGR spent fuel. The engagement period on this paper closed at the end of February 2012 and at this point we had received nine responses from both organisations and individuals.
- 5.2 Some of the responses agreed with our decision to conclude THORP operations in 2018 at the completion of the reprocessing contracts. Notably, EDF Energy, our largest customer for spent fuel management services, has stated that it has no need for THORP's reprocessing services for the management of Sizewell B fuel or any spent fuel coming from any new power stations that it plans to build and operate.
- 5.3 Some of the responses did not agree with the decision to conclude THORP operations in 2018. Some respondents expressed a view that there is an economic case for continuing to invest in THORP and its associated infrastructure so that it can operate beyond 2018 and take on new overseas reprocessing contracts. However, in our view, to keep THORP open significantly beyond 2018 would require a major, multi-billion pound investment programme with like-for-like replacement of many support facilities

average life extension of seven years across the AGR fleet." Taken from: http://www.edfenergy.com/about-us/shareholder-information/documents/AGR_Life_Extension_Expectations_-_16.02.12.pdf

with little or no prospect of significant new business and hence a return on this investment.

5.4 Some of the respondents expressed the view that reprocessing of AGR spent fuel would be more cost-effective over the long-term compared to storage and disposal to a GDF. Our economic assessment has concluded that a “store and dispose” strategy is the most cost-effective means of managing AGR spent fuel. This is particularly so given the major investment programme that would be required to operate THORP for the duration of the AGR power stations, if they receive significant lifetime extensions. Furthermore, a GDF is still required to dispose of the vitrified product from reprocessing and any spent MOX fuel if the plutonium was reused in this way. However, if in the future the economics of spent fuel recycling were to change, due to pressures with uranium supply or concerns over energy security, then the AGR spent fuel could be removed from storage and reprocessed.

5.5 Some of the respondents expressed the view that reprocessing of AGR spent fuel was the most assured way of managing it. For over 30 years AGR spent fuel has been safely and successfully stored in ponds at Sellafield. Whilst we are confident in this means of storing AGR spent fuel until it can be disposed of, we will continue with our work on alternative options to wet storage, including dry storage and the early packaging of fuel for storage pending disposal.

6 OUR PLANS FOR MANAGING OXIDE FUEL BEYOND THE CLOSURE OF THORP IN 2018

6.1 Beyond the closure of THORP, our plans for AGR spent fuel are to interim store it pending packaging for disposal in a GDF which, based on current predictions, is planned to start in 2075.

6.2 In between now and this date, there will undoubtedly be future decisions on when and how to dispose of AGR spent fuel. Whilst we have plans for the disposal of spent fuel from 2075 onwards the NDA is still many years from

making final decisions on the design of the disposal concept and facility in which the spent fuel will be emplaced (ie the GDF).[13]

6.3 Through the Managing Radioactive Waste Safely White paper the UK Government has set out its approach to the disposal of spent fuel and other higher activity wastes.[14] The implementation plan for development of a GDF is at an early stage and in line with the MRWS White Paper is based on the principles of partnership and voluntarism.

6.4 RWMD has developed a range of concepts for the disposal of higher activity wastes including spent fuels. A generic disposal system safety case has been prepared by RWMD and this has been reviewed by Regulators.[15] The development of generic disposal system safety case and its review by Regulators has provided confidence that a safety case for a GDF in the UK could be made, providing a suitable site is available.[16]

6.5 RWMD has assessed the disposability of suitably packaged AGR spent fuel against the generic disposal system safety case and concluded that it is feasible. Work is continuing to optimise the disposal concept for AGR fuel and address some uncertainties associated with its disposal.[15]

6.6 At this stage the site selection and timescales for the availability of a GDF to accept spent fuel for disposal is uncertain. The nature and location of a site, including its physical and geological characteristics, will influence the design of the disposal concept and facility.

6.7 As the site of the GDF and timescales for disposal of spent fuel are uncertain we do not believe there is a case, at this time, for declaring the spent fuel as waste, packaging it for disposal and then storing the conditioned waste spent fuel package until it can be disposed of.

6.8 We will continue, therefore, with our approach to interim storage and disposal of AGR spent fuel with Sellafield Ltd and RWMD.

[13] For example, at the request of The Minister of State for Energy, Charles Hendry, RWMD has reviewed potential options to accelerate the implementation of the geological disposal of higher activity radioactive waste. This review has examined options to reduce the timescales for first emplacement of spent fuel to as early as 2040. This work was recently published, see <https://www.nda.gov.uk/documents/upload/Geological-Disposal-Review-of-options-for-accelerating-implementation-of-the-Geological-Disposal-programme-December-2011.pdf>

[14] Further information on the MRWS process can be found at the DECC website, see: <http://mrws.decc.gov.uk/>

[15] For further information on our work in this area please see the RWMD website; <https://www.nda.gov.uk/aboutus/geological-disposal/rwmd-work/dssc/>

[16] For a summary of the Regulatory review please see; <http://publications.environment-agency.gov.uk/PDF/GENW1211BVDX-E-E.pdf>

7 CONFIRMATION OF OUR STRATEGIC POSITION ON OXIDE FUELS

7.1 The options development, analysis and arguments presented in the Credible Options paper on oxide fuels still stand and are not repeated here.[4] However, for ease of reference a short summary of the oxide spent fuel inventory and the Executive Summary of the Credible Options paper are provided in Appendices A and B respectively.

7.2 Since we published our strategic position on oxide fuels we have continued our work to secure the two conditions upon which its confirmation depended. We have also considered the stakeholder responses to it.

7.3 As explained in section 3 we now believe that these two conditions have been met.

7.4 Since 2011 new information has also emerged on the availability of new evaporative capacity to support reprocessing and potential lifetime extensions to the AGR fleet. We have considered these aspects and have come to the view that they do not change our strategic position.

7.5 Having secured these two key conditions and considered this new information we have confirmed our Preferred Option for the management of oxide fuels which is that:

- Completing the reprocessing contracts in THORP remains a viable and cost-effective strategy and,[2]
- We plan to place the remaining AGR fuel, including any future arisings, into interim storage pending a decision to dispose to a GDF.

7.6 There are, however, a number of performance risks that could impact on the delivery of the strategy. In some scenarios operational difficulties could result in the reprocessing of less than the currently planned amount of spent fuel by late 2018, the date by when reprocessing in THORP is expected to be completed. We believe, therefore, we should continue to examine alternative options so that we can manage these risks to the delivery of our strategy.

7.7 We would expect to provide periodic updates on our progress with the implementation of the oxide fuel strategy in the future. As part of this we will review the progress and health of our strategy for oxide fuels on an annual basis.

APPENDIX A

A SUMMARY OF THE INVENTORY, OWNERSHIP AND CONTRACTS OF OUR OXIDE SPENT FUELS

- A.1 Oxide fuel is used in Advanced Gas-Cooled Reactors (AGR) operated by EDF Energy in the UK, and in Light Water Reactors (LWR) operated by numerous utilities throughout the world. Oxide fuel is reprocessed in the Thermal Oxide Reprocessing Plant (THORP) at Sellafield which started operation in 1994.
- A.2 Reprocessing of spent fuel in THORP provides uranium and plutonium products that can be potentially reused by our customers in new nuclear fuel, such as MOX. An alternative approach to reprocessing for managing AGR spent fuel is to store it in purpose built ponds or dry stores, pending a decision at some point in the future to either dispose of the fuel to a geological disposal facility (GDF) or to reprocess it.
- A.3 After the NDA took over the UK's nuclear liabilities, it inherited from BNFL a range of spent fuel management contracts with domestic and overseas customers.
- A.4 The NDA is contractually committed to receive and manage all spent fuel arising from the seven EDF Energy AGR power stations in England and Scotland. The contracts and ownership of AGR spent fuel reflect the many changes to the UK energy and nuclear industry that have occurred since the first AGRs were commissioned in mid- 1970s.
- A.5 Based on current projections of the lifetime of the AGR fleet we estimate there remains about 6,200 teU of spent fuel for NDA to manage. About a third of this fuel is contracted with EDF Energy for reprocessing and the remaining two-thirds of this fuel is contracted for reprocessing or storage at our discretion. It should also be noted that, of the lifetime arisings of AGR fuel, about half is owned by EDF Energy and about half is owned by the NDA.[17,18]
- A.6 If EDF Energy chooses to extend the lifetimes of its AGR fleet this will increase the amount of fuel we have to manage. The fuel arising from these potential station extensions is covered by the contracts between EDF Energy and NDA and would be owned by NDA. Under the terms of our contracts we

[17] The split ownership of AGR spent fuel reflects the solvent restructuring of British Energy in late 2004. Fuel loaded into reactors prior to midnight on the 14 January 2005 is owned by EDF Energy and is referred to as 'historic' fuel; fuel loaded after this date is owned by NDA and is referred to as 'future' fuel.

[18] The NDA does not hold any contracts for, nor is it liable for the management of spent fuel from Sizewell B or from any potential new nuclear reactors.

are obliged to receive and manage all the AGR spent fuel coming from EDF Energy's AGR power stations.

A.7 Typically EDF Energy's AGR fleet discharges about 180 teU of spent fuel each year to Sellafield. Therefore, if EDF Energy extended its entire AGR fleet by seven years we would have to manage about an additional 1260 teU of spent fuel.

A.8 The NDA also holds contracts to reprocess overseas-derived LWR fuel in THORP that has been received and is being stored at Sellafield. The contracts also cover the management of products and, as appropriate, the return of conditioned wastes to customers. There remains about 300 teU of the overseas-derived LWR fuel to reprocess. This means THORP has now completed over 90% of its order book for overseas fuel reprocessing.

A.9 There is also an inventory of oxide fuels which the NDA has inherited from the UKAEA. These fuels generally came from prototype reactors from the UK's historic nuclear energy development programmes. There is approximately 150 teU of this spent fuel and it is scheduled to be reprocessed in THORP.

A.10 A summary of the overseas- and UK-owned oxide spent fuel inventory for which the NDA holds contracts to manage is provided in Figure 1, overleaf. The diagram reflects the amounts of fuel committed by the contracts to be reprocessed, the "THORP order book", and the amounts which can be stored or reprocessed at the NDA's discretion.

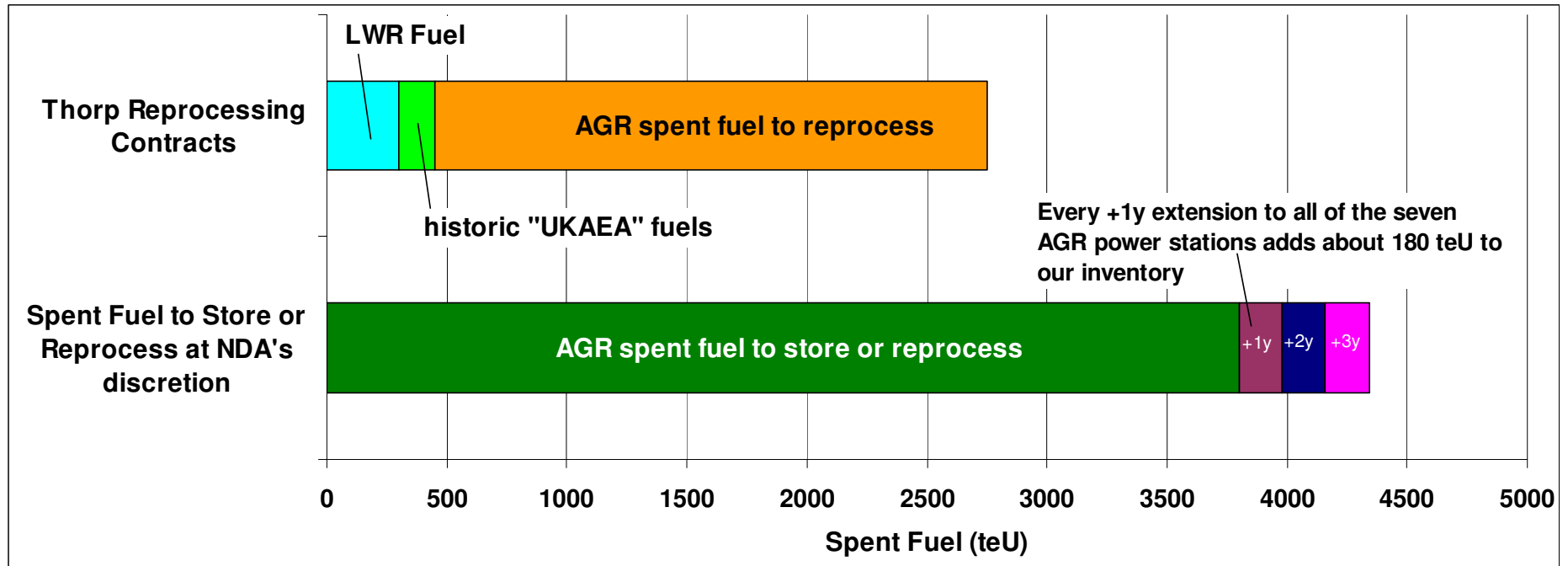


Figure 1 The NDA's oxide spent fuel inventory committed by our contracts to reprocessing and/or storage

APPENDIX B CREDIBLE OPTIONS SUMMARY – REPRODUCED FROM REFERENCE [4]

Executive Summary

Background

After the NDA was formed it inherited a range of contracts covering reprocessing and storage of oxide spent fuels. Our strategy for oxide fuels is to honour our contractual obligations and complete the reprocessing contracts in THORP and place any remaining fuels into storage.[19]

THORP was expected to complete the reprocessing contracts by 2010. However, due to operational difficulties both in THORP and in downstream support plants this has not been possible. THORP is now expected to complete the reprocessing contracts in 2018.

Approach

In accordance with the commitment given in our 2011 Strategy, the NDA has been investigating whether the current strategy for managing our oxide fuels, compared to other credible alternatives, remains the most cost-effective.

This paper reports the key findings of this review of the underpinning for the strategy. It presents the Credible Options for oxide fuels and our assessment of them against a number of criteria. The details of this assessment are given in Section 3.

The options considered were;

- **Option 1:** Complete the reprocessing contracts in THORP — the current strategy for oxide fuels
- **Option 2:** Reprocess less than the contracted amount of spent fuel in THORP
- **Option 3:** Reprocess more than the contracted amount of spent fuel in THORP.

Key Findings

Our analysis has shown that the amount of fuel that should be reprocessed in THORP on economic grounds is comparable to the amount that is contracted to be reprocessed. This is due to a number of interacting factors which results in an alignment of economic and commercial drivers. Therefore, the delivery of the current strategy (Option 1), to complete the reprocessing contracts, remains the most viable and cost-effective option.

[19] To complete the current reprocessing contracts some flexibility will be required around some very small amounts of the overseas fuels. They amount to about less than 0.1% of the THORP order book by mass.

Following the closure of THORP in 2018 we plan to place the remaining AGR fuel into interim storage pending conditioning and disposal to a Geological Disposal Facility (GDF). Future reviews and decisions will confirm how to manage it for the long-term.

We have also considered extending the reprocessing of fuel in THORP beyond the amount required by the contracts (Option 3). This includes AGR fuel and potential new business from domestic and overseas customers.

Delivering our strategy carries some performance risks. We will, therefore, continue to examine options to optimise the strategy and keep it cost-effective. This includes the option to reprocess less than the full contracted amount of spent fuel in THORP in case it is needed (Option 2).

Our analysis has shown reprocessing further AGR fuel beyond that needed to create space for interim storage is not a cost-effective means of managing it compared to Option 1.

The success of delivering our strategy depends on two key conditions;

- a. Obtaining the required performance across our existing reprocessing assets
- b. Securing an agreed means for the interim storage of the remaining AGR spent fuel.

We believe meeting these conditions is highly credible and our case to do so is well-advanced.

Way Forward

NDA's Strategy for Oxide Fuels

Our strategy for THORP and the future management of AGR spent fuel is subject to meeting the conditions (a) and (b) above. We will continue our work to underpin our strategy and expect to complete it by summer 2012, when it would be confirmed as our preferred strategic option.

THORP and the Long-term Potential for Reprocessing in the UK

Our strategy to close THORP following completion of the reprocessing contracts has potentially wider policy implications for spent fuel management in the UK.

The Government has, therefore, asked the NDA to use our work as the basis for providing advice to them about the wider, long-term potential for reprocessing in the UK. In section 8 we have set out our views on this, in the context of current Government policy and the currently foreseeable situation in the UK.

As well as feedback on our business decision about THORP and AGR fuel we are also therefore interested in receiving views on the long-term potential for reprocessing in the UK.

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