Nuclear Decommissioning Authority

Issue 1

November 2016

NDA Research Board – NDA Response to Position Paper Recommendations

NDARB025

NDA Response to Recommendations – Review of NDA's Spent Fuels R&D Programme (NDARB016) Issue 1

November 2016

About the Independent NDA Research Board

Despite its title, the Research Board has terms of reference which cover the Research and Development (R&D) interests for waste management and decommissioning of the UK, not just the that of the NDA. Given the scale of the NDA's work in this sphere however, much of its time is dedicated to the NDA's own programme. Although the Board works cooperatively with the NDA, which provides the secretariat, it is independent. Neither its programme of work or published opinions have to be agreed with the NDA. Its membership comprises experts in the field and senior representatives of key stakeholder organisations such as Government departments and regulatory bodies. Its role is advisory only, reporting to Government departments via their Chief Scientific Advisors and to the main NDA Board. Further information on the Board can be found at www.nda.gov.uk.

EDRMS No. 25873263

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1 Introduction

The following text details the NDA responses to the recommendations published in NDA Research Board Position Paper 'Review of NDA's Spent Fuels R&D Programme' (NDARB016). The original review document and further information on the NDA Research Board can be found on the NDA public website www.gov.uk/nda

2 NDA Response

NDA response to Research Board Recommendations

Recommendation	Detail	Response
1 (Page 3)	The intention to move to caustic dosing of the storage pond in 2018 is near term and critical. Although there is good experience of this regime on the Sellafield site it is imperative that the R&D work to underpin this change is completed as soon as possible. The Board also recommends	**Accepted** Besides good operational experience of this regime, Sellafield Ltd's (SL) assessments have concluded that wet storage in the THORP pond is the best available technique from both a technical and environmental standpoint. This approach has been agreed with the respective regulators. The NDA has conducted its own studies and commissioned independent peer-reviews of SL's assessments. These reviews have supported the view that interim pond storage of AGR fuel is the best available method for managing the remaining fuel following a closure of THORP. The technical work will be reviewed as part of the safety case submission expected in 2017. Limited R&D work is required by SL, primarily to expand the envelope to support higher temperature fuel storage in caustic in 63e racks and to demonstrate transition to caustic pond conditions. SL is also doing destructive examination of fuel that has been in long-term storage or subject to corrosive conditions as part of experimental trials. NDA is also continuing strategic R&D work under its Direct Research Portfolio (DRP) scope to evaluate the possibility of longer term caustic storage by improving understanding of the potential cladding corrosion mechanisms, and the role of caustic in inhibiting Radiation Induced Sensitisation (RIS) corrosion.

Recommendation	Detail	Response
2 (Page 4)	The NDA has already made efforts to collect the earlier R&D on fuel drying and dry storage conducted by the former electricity utilities in the UK; there should be effort to ensure this earlier work is not lost.	**Accepted** The relevance of much of the earlier work around the “Scottish dry store” that has been collected and consolidated is currently being reviewed as part of an NDA Direct Research Portfolio (DRP) project. Part of this work has been ensuring the custody of the information held by Sellafield Ltd and National Nuclear Laboratory (NNL) and the DRP project output will ultimately be stored in the NDA Nuclear Archive. The fuel wetting characteristics and drying options are to be subject to a programme of work based on advice from a range of industry experts with the outputs discussed through the AGR Technical Forum.

Recommendation	Detail	Response
4 (Page 5)	Consideration should be given to small tail end quantities of Magnox (and perhaps also to AGR) fuel. R&D may be needed to assess the practicalities of using the reprocessing plants for these or for how they can be otherwise addressed.	**Accepted** Close out of the Magnox Operating Programme (MOP) is an important piece of work over the next 5 to 10 years. The plant end state (for example the quantity and type of tail end material) is still being defined and will determine the exact plant end date. In turn this will inform SL's final programme. Work will consider the likelihood of any tail end quantities and the options for dealing with them such as continued reprocessing and other options. The R&D necessary to technically underpin storage and subsequent disposal of residual Magnox fuel debris from decommissioning legacy ponds and silos will bound the requirements of disposal of un-reprocessed Magnox (and DFR) fuel and residues. Work by SL is ongoing to these ends. The Scope of the Oxide and Exotics R&D plans already includes work to underpin disposal of residual quantities of un-reprocessed oxide fuels.

Recommendation	Detail	Response
6 (Page 6)	While the NDA believes that the Exotic fuels are generally stable from a corrosion perspective (most of them having been stored at various locations within the UK for many years) it seems to the Board urgent to review the data to confirm both the overall inventory characteristics and that the current storage conditions are appropriate. If not, further action, possibly including R&D, will be necessary.	**Accepted** All the current exotic fuel legacy stocks have been in storage for prolonged periods of time. Although there is no indication that any urgent action is necessary due to deterioration of any of the stocks (as opposed to improved cost efficiency of consolidating storage), work is ongoing to evaluate the condition of the stockholding and storage arrangements to: • confirm the acceptability of current/proposed storage arrangements in the medium term; and • provide the basis for prioritisation and scope of the Exotics R&D Roadmap which is currently being developed. Any identified work will probably be progressed via NDA's Direct Research Portfolio.
7 (Page 7)	If the intention is to use the THORP and the Magnox reprocessing plants whenever possible for these materials [Exotics], both are closing in significantly less than a decade. It must therefore be an urgent matter to conduct investigation to identify those Exotic fuels for which there is a possibility to process by these two routes.	**Noted** Both reprocessing plants are scheduled to complete commercial operations within 5 years. In line with the recommendation all existing opportunities have been considered as part of this approach. Unfortunately it may not be economically viable and practicable to achieve further opportunities.

Recommendation	Detail	Response
8 (Page 7)	As R&D programmes are developed to deal with treatment of the more difficult Exotic fuels it would be appropriate to have close liaison with the Nuclear Innovation and Research Advisory Board (NIRAB). It may be that such R&D (for example pyro-processing) would have similar interests as those of NIRAB for advanced fuel cycles.	**Agreed** The development of the Exotics R&D Roadmap will identify any need to stabilise or treat materials for interim storage or for disposal. Options for necessary treatment routes will take into consideration any relevant experience of treating such materials elsewhere as well as development programmes in the UK or elsewhere which may be relevant. The work on advanced fuel cycles will be considered although where possible simpler treatment methods may meet the needs of fuel stabilisation and disposal. NDA agree with the recommendation and will continue to work with NIRAB and its subgroups to seek and develop such opportunities.

Recommendation	Detail	Response
9 (Page 9)	As discussed earlier in this document, the Board would like to see: • Appropriate R&D to resolve the issue of the 2% of the Magnox fuel inventory, for which it is believed drying cannot be achieved in order to satisfactorily dry store the fuel. • Early resolution of the total Exotics inventory characteristics and confirmation of, or work to establish appropriate long term storage. • Early R&D to identify those Exotics for which use of THORP and the Magnox reprocessing plants may be appropriate, before the opportunity is lost.	**Accepted** Close out of the Magnox Operating Programme (MOP) is an important piece of work over the next 5 years. The plant end state (for example the quantity and type of tail end material) is still being defined and will determine the exact plant end date. In turn this will inform SL's final programme. Work will consider the likelihood of any tail end quantities and the options for dealing with them which would include continued reprocessing and other options. The R&D necessary to technically underpin storage and subsequent disposal of residual Magnox fuel debris from decommissioning legacy ponds and silos will bound the requirements of disposal of un-reprocessed Magnox (and DFR) fuel and residues. Work by SL is ongoing to these ends. Consideration of drying degraded fuel from First Generation Magnox Storage Pond (FGMSP) concluded that, fuel drying and dry storage is viable but a significant number of issues to address the process safety case were identified. Further work would be required to extend fuel drying technology to all potential Magnox fuel including debris. What work is done will be considered in the context of a solution for all of the fuel that could remain at the completion of the MOP. The work on Exotics is underway as described earlier in recommendation 6. The THORP and Magnox reprocessing plants are scheduled to complete commercial operations within 5 years. As outlined in response to recommendation 7 all existing opportunities have been considered as part of this approach. Unfortunately it may not be economically viable and practicable to achieve further opportunities.

Recommendation	Detail	Response
10 (Page 10)	In its earlier review of the RWMD R&D programme, the Board was pleased to see RWMD's efforts with respect to the establishment of a Knowledge Base and long term data management which would include the results of R&D programmes. While the timescales for spent fuel management and disposal are not as lengthy, they do extend over many decades. The Board would like to see that the good practices being adopted elsewhere are also being employed for the long-term in the field of spent fuel management.	**Agreed** Information and Knowledge Management is recognised as a key component of NDA's mission and Strategy. NDA has recently published two relevant documents: • Knowledge Management – Best Practice Guide (IMG01) • Managing NDA Information: Requirements (IMP06) As part of our Strategy, a nuclear archive will be constructed in Wick, Scotland. NDA will continue to investigate good practice in Information and Knowledge Management in line with our strategy and where appropriate adopt it.

Recommendation	Detail	Response
11 (Page 10)	As noted above, the strategic approach for Exotic fuels is under-developed at present. In particular, the assumption that current storage arrangements for all such fuels are appropriate seems unproven. While work is intended in this area, currently the programme for Exotic fuels is not robust to change and, as indicated earlier, in the Research Board's view some aspects need more urgent attention.	**Accepted** The development of the Exotics R&D Roadmap, which was initiated in 2014, will identify any need to stabilise or treat materials for interim storage or for disposal. Options for necessary treatment routes will take into consideration any relevant experience of treating such materials elsewhere as well as development programmes in the UK or elsewhere which may be relevant. The work on advanced fuel cycles will be considered although where possible simpler treatment methods may meet the needs of fuel stabilisation and disposal. Generally the requirements are more likely to align with existing work on drying/immobilisation with potential requirements to consider management of the more reactive (i.e. fissile) sub-populations. The limited outlier quantities in question are unlikely to justify sophisticated process development. DFR breeder residual stocks are potentially likely to align with LP&S Magnox residue development.
12 (Page 10)	The NDA's R&D programme for spent fuels is dependent on a singleton in house expert in this area. Given the importance of the topic NDA does not appear to be robust against the potential risk from the loss of this expert. The NDA should review its response to this potential risk.	**Accepted** The NDA is recruiting additional resource to support this area and is continuing to use supply chain resources to develop the R&D roadmaps. There have been ongoing difficulties to recruit appropriate technical resources to this area and short term approaches such as secondments have been employed.

NDA Response to Research Board Observations

Observation	Detail	Response
1 (Page 5) Formerly Recommendation 3	The Magnox Throughput Improvement Programme (MTIP) should be approached with caution; the objective should be for the plant to last until all the fuel has been reprocessed. If this takes a little longer, is it worth a small time extension to avoid stranded fuel.	**Observation Noted** NDA have built realistic, back-to-back plans with SL and Magnox Ltd, which are reflected in the Magnox Operating Programme (MOP), with the aim of ensuring infrastructure across the whole MOP is managed appropriately to achieve the objective as early as practicable. The focus of the (MTIP) is to improve delivery confidence and resilience in the long term. Steady state operating models have been deployed that avoid, where possible, the need to stress the plant to achieve short term operational benefit. MTIP initiatives include development of standard operational models, improved operator training, improved technical support to operations, re-establishing dual train capability and improved asset condition and reliability, consistent with completion of the mission. The MTIP supports effective delivery of the programme against these objectives and does not prejudice the viability of the asset. There are no R&D activities required to support this work
2 (Page 5) Formerly Recommendation 5	The MOP should consider the merits of leaving some Wylfa fuel until last if there is an acute risk that the reprocessing plant will be unable to complete all fuel. Similarly there are advantages to any “tail end” fuel being that from Wylfa.	**Observation Noted** As of January 2016 Oldbury fuel has been dispatched to Sellafield, leaving only Wylfa and Calder Hall. The overall schedule is a key consideration in formulating the MOP.