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AREVA NP UK EPR GDA Project

The Case for Disposability of Spent Fuel and ILW

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1. INTRODUCTION

This note provides information on how and when the issues raised by the Radioactive Waste Management Directorate (RWMD) Disposability Assessment of EPR waste and spent fuel will be addressed (i.e. issues raised in Appendix B of the RWMD report and in the EDF/AREVA critique of the assessment).

In developing this document EDF/AREVA have consulted closely with RWMD to ensure that their requirements are fully understood and can be met within the appropriate timescales. A key consideration for RWMD is the role that the Disposability Assessment and the Letter Of Compliance (LOC) processes play in establishing the case for the disposability of the proposed waste packages.

The LOC process (outlined in Section 1.1 below) is a means of developing confidence in the waste packaging proposals submitted by waste producers. The Disposability Assessment process was developed specifically for the Generic Design Assessment (GDA) and was essentially designed as a pre-stage 1 LOC submission. In practice RWMD consider that the information supplied by EDF/AREVA for this disposability assessment included most of the information that would be required for a Stage 1 LOC submission. It should also be noted that the information supplied by EDF/AREVA to date has been designed for the GDA and has addressed options for potential site operators. Specific details concerning these options will be addressed by site operators once their technology choices have been made (e.g. selection of ILW container, detailed specification of materials, etc). Based on these points, RWMD consider that the additional information needed to fully develop the packaging proposals can be provided as part of the LOC process. This process will be undertaken by the site operator and this is made clear in the remainder of this document.

1.1 Outline of the LOC Process

To set the context the RWMD LOC process is described briefly below and the broad requirements are discussed relating the different stages of the LOC process to different waste management issues. It should be noted that the LOC process is very flexible and can be adapted to suit the needs of specific situations.

1.1.1 Stage 1 – Conceptual LOC

The information requirements for this stage are not extensive. The following items will need to be described in broad terms:

- Waste inventory (bounding estimates are generally adequate)
- Waste characteristics (e.g. resin, sludge, components, etc)
- Wasteform (e.g. encapsulated in cement grout, etc)
- Waste container description



- General waste package properties

RWMD assess a conceptual submission to determine whether or not the proposed waste package is likely to be acceptable. An assessment report is produced including a list of actions and information requirements which will need to be completed for the Interim LOC submission.

1.1.2 Stage 2 – Interim LOC

The interim stage of the LOC process involves a detailed assessment of the waste packaging proposal. The waste producer must provide comprehensive information and evidence to support claims concerning the safety of the waste package, including its behaviour in severe accidents and the expectations concerning the ageing of the package. This stage of the LOC process requires the greatest amount of information from the waste producer.

A report will be produced by RWMD following its review of the interim LOC submission and this will describe any further information requirements that RWMD may have.

1.1.3 Stage 3 – Final LOC

The final LOC submission will usually focus on management issues rather than waste package performance. This will include QA, management arrangements, safeguards to be applied, working procedures, etc.

It is possible for the LOC stages 2 and 3 to be merged, although this is less likely with a project such as the UK EPR because of the timescales involved. The final stage LOC must be complete before the start of operations relevant to particular waste stream in question.

2. ISSUES RAISED IN THE RWMD DISPOSABILITY ASSESSMENT REPORT

EA and HSE are seeking confidence that the issues identified in Appendix B of the Disposability Assessment can be addressed within appropriate timescales. A meeting was held between the EDF/AREVA GDA team and representatives from RWMD to discuss the issues raised in Appendix B of the RWMD report. The meeting discussed each of these issues in turn and came to a conclusion on when and how the issues should be addressed. To assist in setting the context the text in the GDA Disposability Assessment is provided below in italics and the discussion and proposed resolution of the issues is provided in bold text. The bullet points in the GDA Disposability Assessment have been assigned numbers to help in referencing and in future discussions.

In general, EDF, AREVA and RWMD agreed that the resolution of the issues raised in Appendix B of the Disposability Assessment ought to be undertaken as part of LOC submissions made to RWMD by the site operator and should not form part of the GDA process.



B.1 ILW

B.1.1 Proposed Approach to ILW Management

An operator would be expected to provide further information on the waste management approaches adopted for particular plant. Issues that have been identified through the GDA Disposability Assessment for more detailed consideration in the future include a need for the operator to:

- 1. provide further information on proposals for the management of RCCAs;*

The management of Rod Cluster Control Assemblies (RCCAs), and Activated Core Components (ACCs) generally, needs to be specified for the whole UK nuclear industry. It was noted by RWMD that the waste packaging concept for the RCCAs could affect the repository design especially if they are packed with spent fuel. EDF/AREVA may contribute to this process but is not in a position to specify the management proposals for such wastes. Options for the management of ACCs (including RCCAs) will be presented in the Stage 1 LOC submission for operational ILW and will take full account of developments in waste management techniques, including detailed discussions with RWMD.

- 2. confirm the absence of, or provide proposals for, any ILW residues from the incineration of evaporator concentrates;*

EDF/AREVA can confirm that any such wastes would not be ILW and so the issue does not apply.

- 3. confirm whether wastes are intended to be transported in IP-2 or Type B packages.*

The site operator's Stage 1 LOC submissions for operational and decommissioning ILW will need to specify whether the transport packages will be IP-2 or Type B packages.

B.1.2 Information on ILW Characteristics

An operator would be expected to provide further information on the waste characteristics. Issues that have been identified through the GDA Disposability Assessment for more detailed consideration in the future include a need for the operator to:

- 4. provide information on the grade and composition of materials used in an EPR, for example stainless steel, taking account of the nitrogen impurities in the steel and provide information on the form of tritium, C-14, Ar-39, Cl-36 and Se-79 in activated metals;*

Detailed information on this would not be required until the Stage 2 LOC submissions for operational and decommissioning ILW to be prepared by the site



operator, although some bounding composition data would assist the Stage 1 assessment.

- 5. provide detailed information on the chemical composition of the wastes, including toxic element content;*

This aspect is most relevant to activated core components (ACCs) and to the repository post-closure performance assessment. The information would therefore be needed for the Stage 1 LOC submission for operational ILW for ACCs and for the Stage 2 LOC submissions for operational and decommissioning ILW for other wastes. These submissions will be the responsibility of the site operator.

- 6. confirm that the contents of waste packages meet the “contents specifications” for transport, for example that masses of both deuterium and beryllium in the waste packages are less than 1.8g;*

This information, which would be relevant to the transport regulations, would not be needed until the Stage 2 LOC submissions for operational and decommissioning ILW to be prepared by the site operator.

- 7. provide information on the form of tritium and carbon-14 in the waste packages to support realistic modelling of their release during transport and operation;*

RWMD have stated that they based their Disposability Assessment on very conservative assumptions. The assessment could be refined for the Stage 1 LOC submissions for operational and decommissioning ILW if data was made available but it will not strictly be required until the Stage 2 LOC operational and decommissioning ILW submissions. These submissions will be the responsibility of the site operator.

- 8. provide information on the products that would be generated from waste degradation, for example the rates of volatile amines produced by radiolysis and thermal degradation of anion-exchange resins.*

The point relates mostly to ion exchange resins. It will be needed for the Stage 1 LOC operational ILW submission for the cast iron containers where these will contain unencapsulated waste. RWMD would not require this information until the Stage 2 operational ILW submission for encapsulated resins as the behaviour of these wasteforms is well-understood.

B.1.3 Information on ILW Wasteform and Conditioning Process

An operator would be expected to provide information on the wasteform and on the methods used to condition waste prior to its consignment to a GDF. Issues that have been identified through the GDA Disposability Assessment for more detailed consideration in the future include a need for the operator to:



9. *consider the use of alternative conditioning matrices, for example organic resins (vinyl ester styrene systems) as an alternative to the use of epoxy resins to immobilise ion exchange resins, as envisaged for EPR01, and to define the polymer processing envelope in terms of both satisfactory wasteform performance and plant operation;*

RWMD consider that this would be needed for the Stage 1 LOC submission for operational ILW if it is planned to use epoxy resins. These submissions will be the responsibility of the site operator.

10. *demonstrate that any grout used for conditioning of waste suitably infiltrates the waste and immobilises particulates successfully;*

This information would not be needed until the Stage 2 LOC submissions for operational and decommissioning ILW to be made by the site operator.

11. *consider the use of alternative approaches to grouting waste, such as the use of a calcium sulpho-aluminate cement to ensure that grout will set satisfactorily to counter the negative impact that the presence of boron and zinc in sludges (EPR05) may have on cement curing;*

This information would not be needed until the Stage 2 LOC submissions for operational and decommissioning ILW to be made by the site operator, although information may already be available if required for the Stage 1 LOC submissions.

12. *provide data on the mass transport, thermal conductivity, and gas generation and pressurisation properties of the wasteforms;*

RWMD consider that this information would not be needed until the Stage 2 LOC submissions for operational and decommissioning ILW with the exception of unvented waste containers where RWMD would want information for the Stage 1 LOC submission for operational ILW. (Note: this comment applies to the Mosaik casks included in the Disposability Assessment. Vents can be fitted to the Mosaik casks but this is not usually done as it is considered unnecessary. In fact, these waste packages can experience negative pressure compared to the ambient atmosphere as the oxygen within the container becomes used up.)

13. *define the boundaries of the formulation envelope for grout and polymer encapsulants and demonstrate that the plant operational envelope falls within this;*

This information would not be needed until the Stage 2 LOC submissions for operational and decommissioning ILW to be prepared by the site operator.

14. *provide information on the use of capping grouts, for example confirm either that an inactive capping grout is applied to the top surface of all decommissioning ILW wasteforms, prior to lidding of the waste container, or that loose particulate material would not be present and that a capping grout is unnecessary.*



This information would not be needed until the Stage 1 LOC submissions for operational and decommissioning ILW to be prepared by the site operator.

B.1.4 Information on ILW Packaging and Container Design

An operator would be expected to provide information on the container and waste package design. Issues that have been identified through the GDA Disposability Assessment for more detailed consideration in the future include a need for the operator to:

- 15. include information of the material composition of waste containers, including additives and reinforcement, for Reference Case C1 and C4 Casks;*

This information would be needed for the Stage 1 LOC submissions for operational and decommissioning ILW to be prepared by the site operator.

- 16. provide details of waste package handling features;*

This information would be needed for the Stage 1 LOC submissions for operational and decommissioning ILW to be prepared by the site operator.

- 17. confirm that package identifiers would be applied that would be compatible with current requirements;*

This information would be needed for the Stage 1 LOC submissions for operational and decommissioning ILW to be prepared by the site operator.

- 18. demonstrate that wastes to be transported as IP packages meet the LSA requirements of IAEA transport regulations.*

Information would be needed for the Stage 1 LOC submissions for operational and decommissioning ILW to be prepared by the site operator with full details to be provided for the Stage 2 LOC submissions for operational and decommissioning ILW.

B.1.5 Information on ILW Package Performance

An operator would be expected to provide further information on expected waste package performance under accident conditions. Issues that have been identified through the GDA Disposability Assessment for more detailed consideration in the future include a need for the operator to:

- 19. mitigate the risk of mechanical damage to containers during packaging and handling of wastes, for example the potential for damage to concrete casks during waste compaction after placement of ILW in the concrete casks;*

This information would be needed for the Stage 1 LOC submissions for operational and decommissioning ILW but would mostly be limited to clarification of existing information. Detailed information will then be required for the Stage 2 LOC



submissions for operational and decommissioning ILW. These submissions will be the responsibility of the site operator.

20. demonstrate whether the wasteform or the waste container would be load bearing in the case of waste packages being stacked one on another;

This information, which is required mostly for the C1 and C4 containers, would be needed for the Stage 1 LOC submission for operational ILW. Detailed supporting information will then be required for the Stage 2 LOC submission. These submissions will be the responsibility of the site operator.

21. provide results from modelling or test work to better define the damage and the release from waste packages under impact accidents, and the heat loading and the release from the waste packages from fire accidents;

This information would be needed for the Stage 1 LOC submissions for operational and decommissioning ILW. Detailed supporting information will then be required for the Stage 2 LOC submissions. These submissions will be the responsibility of the site operator.

22. consider the deterioration in the mechanical strength of waste packages owing to storage, and the impact of such deterioration on the accident performance;

This information would not be needed until the Stage 2 LOC submissions for operational and decommissioning ILW to be prepared by the site operator.

23. provide information on the performance of non-standard packages under impact events and fire.

This information, which is required for the C1 and C4 containers and the Mosaik casks, would be needed for the Stage 1 LOC submissions for operational and decommissioning ILW. Detailed supporting information will then be required for the Stage 2 LOC submissions. These submissions will be the responsibility of the site operator.

B.2 Spent Fuel Issues

At the current stage of development of plans for spent fuel waste management, RWMD is taking the lead in developing designs of disposal canisters. These designs are an integral part of the disposal concept which would be determined by the geological host environment. RWMD would continue to work with potential operators to ensure that they are aware of the latest thinking in respect of disposal canisters.

Spent fuel issues identified during the GDA Disposability Assessment and which would need to be addressed through LoC interactions are primarily associated with understanding of the waste characteristics. In any future submission under the LoC process, the operator would be expected to:



24. build confidence in the expected levels of cladding failure as a result of adoption of Zircaloy M5;

This information would not be needed until the Stage 2 LOC submissions for Spent Fuel (SF) to be prepared by the site operator.

25. provide information on the distribution of burn-up around the average and maximum and on irradiation history, to support modelling of radionuclide inventories;

This information would be needed for the Stage 1 LOC submissions for SF to be prepared by the site operator.

26. provide information on the properties of spent fuel following irradiation at high burn-up to support assumptions regarding long-term integrity of spent fuel, including estimation of the IRFs;

Detailed information on this will not be required until the Stage 2 LOC submissions for SF although it will need to be considered in broad terms within the Stage 1 submissions. These submissions will be the responsibility of the site operator.

27. provide information that could be used to evaluate the potential for the spent fuel canister to be subject to significant gas pressurisation under both normal and fire accident conditions

In normal circumstances there should be no pressurisation of SF canisters. However, this could happen if the SF is not adequately dried. The Stage 1 LOC submission for SF will need to include a statement on the intentions with regard to the drying of the SF before encapsulation. (Note, the management of SF remains subject to further development, including work currently being undertaken by RWMD.)

3. ISSUES RAISED IN THE EDF/AREVA CRITIQUE

In addition to the issues raised in Appendix B of the Disposability Assessment, a critique of the Disposability Assessment by EDF/AREVA raised a number of other points. These are presented in italics below and the proposed resolution of these issues is presented in bold text.

3.1 *Fuel Burn-up*

Information provided to RWMD specified that the maximum burn-up for an EPR fuel assembly would be 65 GWd/tU as a bounding case. RWMD has assumed this value as the burn-up for all fuel-assemblies. However, RWMD also calculated that, based on an assumption of 3600 fuel assemblies over 60 years and a load factor of 93%, the average burn-up would be 48.3 GWd/tU. (Note, the assumption of 3600 fuel assemblies is wrong; the number is expected to be up to 3400.)



This calculated average burn-up was not used in the assessment although some calculations were undertaken on a variant case using a burn-up of 50 GWd/tU. It was also determined that using a value of 48.3 GWd/tU would decrease the amounts of radionuclides of post-closure significance by about 30%.

Using a bounding estimate of the burn-up in the assessment tends to overestimate the heat output of the spent fuel, the radionuclide inventories of waste arisings and the volumes of operational and decommissioning ILW, although the RWMD assessment using these overestimates still concludes that no problems or issues are foreseen for the disposability of the wastes.

It is expected that more detailed analyses will be undertaken to provide better estimates of the average and maximum burn-up rates. The results of these analyses will support future submissions under the Letter of Compliance (LOC) process. These analyses will also take account of the link between burn-up and fuel management strategies.

The site operator would be expected to provide preliminary information on the range of fuel burn-up to be experienced by the reactor's fuel elements fuel burn-up, including information on the associated management practices. Some information would be needed for Stage 1 LOC submission but fully detailed information will not be required until the Stage 2 LOC submission.

3.2 *Assessment Inventories*

For LOC assessments, inventories would typically define both a best-estimate and a bounding case. In this assessment the operational ILW arisings are best-estimates, decommissioning ILW arisings are bounding estimates and spent fuel arisings are bounding estimates. Assessments will be undertaken to provide improved estimates of both bounding case and best estimates of waste and spent fuel inventories. This will require more detailed modelling of activation in the reactor core, components and bioshield including consideration of issues such as the levels of key contaminants (e.g. chlorine and nitrogen) in certain materials used in the reactor and fuel assemblies. The refined inventory data will be used in future assessments and in detailed LOC submissions.

The site operator would be expected to provide bounding estimates of the waste inventories with the Stage 1 LOC submission. Detailed information will not be required until the Stage 2 LOC submission.

3.3 *Serious Fuel Clad Failures*

The Disposability Assessment assumed that the reactor runs at all times with one failed fuel element leaking actinides and other radioactive contaminants into the primary cooling circuit. The effect of this assumption is that ion exchange resins will contain much greater levels of contamination and the primary cooling circuit, including pipework and pumps, will become highly contaminated. The assumption also leads to the RWMD assessment that there would be around 40 g of fissile material in all operational and decommissioning ILW.



We consider that the RWMD assumption that the EPR routinely operates with one serious cladding failure at all times is extremely pessimistic and leads to a significant overestimate of the level of long lived alpha emitters in both the operational and decommissioning ILW waste streams. The contamination of the primary circuit would also create significant operational issues which would affect maintenance procedures. For reasons of waste minimisation and operational efficiency the EPR would not be permitted to operate in this way and any cladding failures will result in the immediate removal and replacement of the faulty fuel assembly.

We are undertaking further work on fuel cladding integrity and future assessments will be based on improved specification of the bounding case for serious clad failure in terms of failure frequency and operational management of failure events to specify better estimates for operational and decommissioning ILW arisings.

The site operator would be expected to provide a justification for the frequency, duration and consequences (e.g. in terms of release of actinides and fission products) of fuel cladding failures with the Stage 1 LOC submission. Further detailed information will be required for the Stage 2 LOC submission.

3.4 *Spent Fuel Interim Storage*

The assessment of spent fuel disposal is partly based on an assessment of the acceptable heat output to meet the surface temperature requirement for bentonite. RWMD has estimated that it would require approximately 100 years for the heat output of the spent fuel to reduce to an acceptable level. However, this is based upon assumptions concerning the 65 GWd/tU burn-up referred to above and on an assumption that the disposal concept is for four spent fuel assemblies to be placed into each canister. Alternative assumptions will affect these calculations and we note that the Disposability Assessment also says that the cooling period required before emplacement is reduced to 56 years if three spent fuel assemblies that have been exposed to a burn-up of 50 GWd/tU fuel assemblies are disposed of in a canister.

As the GDA process continues, further work will be undertaken to specify in more detail the expected heat output from the fuel assemblies and to define the spent fuel packaging concept and associated requirements and constraints. The storage of spent fuel for 100 years is potentially in conflict with the existing design assumptions concerning the on-site storage of spent fuel. This issue needs clarification and further assessment and it is noted by RWMD that options exist to allow the cooling period to be reduced. Issues to be addressed will include consideration of burn-up, improved estimation of the radionuclide inventory in spent fuel and the effect on heat output from spent fuel.

The site operator would be expected to describe the SF interim storage proposals in broad terms for the Stage 1 LOC submission and will need to provide a basis for assumptions regarding the storage period. Further detailed information will be required for the Stage 2 LOC submission. (Note, following discussion with RWMD the work to be undertaken will form part of the LOC process, not the GDA process.)



3.5 *Supplementary Data*

RWMD has supplemented the information supplied to them with its own knowledge and experience, especially relating to wastes arising from the Sizewell B PWR. However, the need for and means of estimating or otherwise defining the supplementary data is not always clear, particularly with regard to the conservatism inherent in the methods of deriving the supplementary data.

There was not sufficient information in the draft Disposability Assessment to allow the full implications of the identification and use of supplementary data to be considered in detail. While it is considered unlikely that RWMD will have used supplementary data without justification, it remains possible that the data selection may be overly conservative or that it may be based on a misunderstanding of the EPR.

No response required.

3.6 *Operational ILW Reference Case*

It is suggested by RWMD (Section 4.2.3) that the reference case waste packaging concept for operational ILW may exceed acceptable doses for transport. This suggestion is based on assumptions concerning the shielding provided in the waste containers. It will be normal practice to specify the level of shielding that is appropriate to particular waste streams. Knowledge of the waste streams (e.g. by direct monitoring) will enable the specification of waste packages and shielding that will comply with dose limits.

It is also suggested by RWMD (Section 4.2.3) that the reference case waste packaging concept for operational ILW may exceed acceptable operational doses at the GDF. We consider that the risk of excessive doses from EPR waste packages is similar to the risk associated with packages containing legacy wastes and that the risk would be managed in the same way. We also consider that the RWMD approach does not take due account of the operational procedures that would be put in place. These would ensure that the waste package shielding requirements are appropriately defined and that the emplacement of waste into each container will be monitored and controlled to ensure that no such breaches occur.

(Note, the comments concerning possible breaches of operational dose limits are repeated for the two variant operational ILW waste streams and for the decommissioning ILW wastes. The comments made above will apply equally to these waste streams.)

The site operator would not be expected to provide detailed information until the Stage 2 LOC submission.

3.7 *Operational ILW Packaging – Variant 1*

It is noted by RWMD that this variant, while making use of a container type that is compliant with RWMD requirements, does not make efficient use of the available packaging volume. However, we also note that this variant packaging concept would lead to a reduction in the overall packaged waste disposal volume as compared to the reference case.



The packaging concepts will be further developed during the course of the GDA process and this will include more detailed assessment and specification of various parameters relevant to waste packaging.

The site operator would be expected to describe the packaging concept in broad terms for the Stage 1 LOC submission. Further detailed information will be required for the Stage 2 LOC submission. (Note, following discussion with RWMD the work to be undertaken will form part of the LOC process, not the GDA process.)

3.8 *Operational ILW Package – Variant 2*

This packaging proposal uses non-standard containers but RWMD expects that the final detailed packaging proposal would be compliant. It should be noted that RWMD has assumed that the waste is to be packaged in Type B MOSAIK Casks used as transport containers to ensure optimum waste loading. It is recognised by RWMD that further development work would be required to confirm the assumption that Type B Casks will be used rather than IP-2 Casks.

The packaging concepts will be further developed during the course of the GDA process and this will include more detailed assessment and specification of various parameters relevant to waste packaging.

The site operator would be expected to describe the packaging concept in broad terms for the Stage 1 LOC submission. Further detailed information will be required for the Stage 2 LOC submission. (Note, following discussion with RWMD the work to be undertaken will form part of the LOC process, not the GDA process.)

3.9 *Decommissioning ILW*

The decommissioning ILW waste stream is larger in both volume and radioactive inventory than the operational ILW waste stream. Given that the Disposability Assessment is based upon a bounding inventory of decommissioning ILW, we are encouraged by the RWMD conclusions concerning the disposability of the wastes. The definition of the inventory will improve as the GDA progresses and this will allow the packaging concepts to be specified in greater detail, thereby assisting in future assessments for the LOC process.

The packaging concepts will be further developed during the course of the GDA process and this will include more detailed assessment and specification of various parameters relevant to waste packaging.

The site operator would be expected to describe the decommissioning waste characteristics (including volume and inventory) for the Stage 1 LOC submission. Further detailed information will be required for the Stage 2 LOC submission. (Note, following discussion with RWMD the work to be undertaken will form part of the LOC process, not the GDA process.)



3.10 Chloride Impurity Assumption

At the current stage of the GDA we are not able to specify in detail the chloride content of the fuel and fuel cladding. RWMD therefore used a conservatively high chloride content with the result that a high estimate for the chlorine-36 content of the spent fuel assemblies was obtained. (The intermediate half life and potential mobility of chlorine-36 means that it is a radionuclide of concern to RWMD in terms of the post-closure performance of the GDF.)

We will define the upper bounds of the chloride impurities allowed in the fuel and fuel cladding for future assessments, allowing a more accurate specification of the management procedures and determination of the risks associated with spent fuel storage and disposal.

Based upon information to be provided as part of the detailed site-specific design, the site operator would provide a justification of the chloride content of the fuel and associated cladding and would use this as a basis for bounding estimates of the chlorine-36 content of SF for the Stage 1 LOC submission. Further detailed information will be provided with the Stage 2 LOC submission.

3.11 Nitrogen Content of Core Components

As with the chloride content, we were not able at this stage to specify the nitrogen content of the stainless steel to be used in the reactor. RWMD therefore used a stainless steel specification with a relatively high nitrogen concentration, leading to a high estimate of the level of carbon-14, particularly in the decommissioning ILW.

We will define the upper bounds of the nitrogen content allowed in the stainless steel for future assessments, allowing a more accurate specification of the management procedures and determination of the risks associated with ILW management, packaging and disposal.

Based upon information to be provided as part of the detailed site-specific design, the site operator would provide a justification of the nitrogen content of the stainless steel and would use this as a basis for bounding estimates of the carbon-14 content in decommissioning wastes for the Stage 1 LOC submission. Further detailed information will be provided with the Stage 2 LOC submission.

4. CONCLUSIONS

On the basis of the discussions held with RWMD and the scope of the GDA process it has been concluded that addressing the issues discussed above will be the responsibility of the site operator as a part of the normal site licensing and regulatory processes. The site operator will need to ensure that it has the necessary information, that all required assessments are complete and that the submissions are made to RWMD at an appropriate time. As noted previously, the LOC process is a means of building confidence in the waste packaging proposals and of establishing the disposability of the expected wastes.

The site operators will also use the staged LOC submissions as a means of minimising certain project risks (e.g. delays to the LOC process may affect design, construction and



operation of waste management facilities) by providing as much information as possible to RWMD early in the LOC process, as has already been done by EDF/AREVA for the GDA disposability assessment.

Finally, a generic timeline for the different LOC submission stages and for the three principal waste categories (SF, operational ILW and decommissioning ILW) has been prepared. This is presented in Figure 1 with some additional explanation of the basis of the timeline given in Table 1.

5. REFERENCES

1. NXA/10747397, Generic Design Assessment: Disposability of Wastes and Spent Fuel Arising from the Operation of the EPR Part 1 Main Report. September 2009.
2. Appendix to letter REG EPR 00182N – Critique of the NDA RWMD Disposability Assessment. 25th September 2009.

**Table 1: Approximate Times for LOC Submissions**

	LOC 1	LOC 2	LOC 3	Comments
Operational ILW	-6	-2	0	<p>The Stage 2 LOC process is linked to the completion of detailed design and the mechanical installation stage for the Waste Treatment Building. This stage should be completed in a similar timescale to the Pre-Commissioning Safety Report, however from a project risk perspective it may be beneficial to gain a Stage 2 LOC in advance of production of the PCmSR.</p> <p>The Stage 3 LOC is linked to the active commissioning of the Waste Treatment Building.</p>
Spent Fuel	-6	+23	+23	<p>The Stage 1 LOC position will establish that a safe and effective means of managing SF is available. It is expected that the Stage 1 LOC will then be subjected to periodic reviews until a Stage 2 LOC can be completed. (The Stage 1 LOC may be revised and updated as required during this time.)</p> <p>The Stage 2 LOC would not be completed until the repository design and the current RWMD work on the SF packaging concept is complete.</p> <p>The Stage 3 LOC would be completed shortly after or possibly concurrent with the Stage 2 LOC process.</p>
Decommissioning ILW	-6	+55	+55	<p>The Stage 1 LOC position will establish that a safe and effective means of managing decommissioning ILW is available. It is expected that the Stage 1 LOC will then be subjected to periodic reviews until a Stage 2 LOC can be completed. (The Stage 1 LOC may be revised and updated as required during this time.)</p> <p>The Stage 2 LOC would not be completed until more detailed information is available on the likely levels of activation products (e.g. based on the reactor operational history and the expected future reactor performance).</p> <p>The Stage 3 LOC would be completed shortly after or possibly concurrent with the Stage 2 LOC process. The Stage 3 LOC needs to be in place prior to the application for consent to decommission.</p>



Figure 1: Approximate LOC Submission Timescales

