Generic design assessment

AP1000 nuclear power plant design by Westinghouse Electric Company LLC

Assessment report
Disposability of ILW and spent fuel

We are the Environment Agency. It's our job to look after your environment and make it **a better place** - for you, and for future generations.

Your environment is the air you breathe, the water you drink and the ground you walk on. Working with business, Government and society as a whole, we are making your environment cleaner and healthier.

The Environment Agency. Out there, making your environment a better place.

Published by:

Environment Agency
Rio House
Waterside Drive, Aztec West
Almondsbury, Bristol BS32 4UD
Tel: 0870 8506506

Email: enquiries@environment-agency.gov.uk

www.environment-agency.gov.uk

GEHO0510BSKI-E-E

Generic design assessment

AP1000 nuclear power plant design by Westinghouse Electric Company LLC

Assessment report - disposability of ILW and spent fuel

Protective status	This document contains no sensitive nuclear information or commercially confidential information.
Process and Information Document[1]	The following sections of Table 1 in our Process and Information document are relevant to this assessment: 2.1 – describe how radioactive wastes will be managed and disposed of 2.4 – provide and substantiate a view on the disposability of higher activity wastes 2.5 – provide and substantiate a view on the disposability of spent fuel (if its direct disposal is proposed)
Radioactive Substances Regulation Environmental Principles[2]	The following principles are relevant to this assessment: RSMDP1 – Radioactive substances strategy RSMDP11 – Storage RSMDP12 – Storage in a passively safe state RSMDP15 – Requirements and conditions for disposal of wastes
Report authors	Ian Barraclough and Paul Abraitis

1. Process and Information Document for Generic Assessment of Candidate Nuclear Power Plant Designs, Environment Agency, Jan 2007.

   http://publications.environment-agency.gov.uk/pdf/GEHO0107BLTN-e-e.pdf

2. Regulatory Guidance Series, No RSR 1: Radioactive Substances Regulation - Environmental Principles (REPs), 2010.

   http://publications.environment-agency.gov.uk/pdf/GEHO0709BQSB-e-e.pdf

Contents

1 Summary

1 This report presents the findings of our assessment of Westinghouse's case concerning the disposability of intermediate level radioactive waste (ILW) and spent fuel from the AP1000, based on information submitted by Westinghouse.

2 We conclude that, subject to a satisfactory demonstration that ILW and spent fuel can be stored safely for the necessary period of time without significant degradation, we see no reason at this stage to believe that any of the ILW or spent fuel from a fleet of nine AP1000s will not be disposable in a suitably designed and located geological disposal facility (GDF).

3 The regulators need more information on the ILW's and spent fuel's potential for degradation over the longer term that might affect its disposability and safe storage. Westinghouse provided information on disposability in March 2010. The regulators have requested information about long term storage and this information is being provided. HSE is reviewing this information in their Step 4 assessment. We will continue to work with HSE on this, and this work will inform our decision document. Our conclusion is, therefore, subject to the potential GDA Issue and other issue:

Potential GDA Issue

a) Disposability of spent fuel following longer term interim storage pending disposal.

Other issue

b) Disposability of ILW following longer term interim storage pending disposal.

4 We conclude that interactions through the course of the generic design assessment (GDA) process have identified a range of issues that will need to be addressed in the future programmes of Westinghouse and/or potential or actual licensees and we note the provisional plan as to how these issues will be addressed through future work. In due course, we will need to see more definitive assessments to confirm how all of the ILW and spent fuel will be conditioned for disposal, that the selected conditioning methods represent the application of best available techniques (BAT), and that in their conditioned forms the ILW and spent fuel will continue to be disposable.

2 Introduction

5 We expect new nuclear power plant to be designed so that radioactive wastes generated from its operation and decommissioning, if they cannot be reused or recycled, can safely be disposed of by existing or planned disposal routes.

6 We set out in our process and information document (P&ID) (Environment Agency, 2007) the requirements for a requesting party to provide information on:

a) How radioactive wastes will be managed and disposed of throughout the facility's lifecycle (reference 2.1);

b) The disposability of any proposed arisings of ILW or high level waste (HLW) (reference 2.4); and

c) The disposability of spent fuel, if the management options include direct disposal (reference 2.5).

7 We published our Radioactive Substances Regulation Environmental Principles (REPs) (Environment Agency, 2010a) in 2010. Principle RSMDP1 states that:

> *"A strategy should be produced for the management of all radioactive substances"*
> and makes clear that the matters that need to be taken into account in such a strategy include: *"The requirement that radioactive wastes are safely disposed of, at appropriate times and in appropriate ways"* and *"How creation of waste, incompatible with current disposal techniques or developing techniques likely to be successful, will be prevented"*.

8 Principle RSMDP12 states that:

> *"Where radioactive substances are currently not stored in a passively safe state and there are worthwhile environmental or safety benefits in doing so then the substances should be processed into a passively safe state"* and the considerations to be taken account include: *"The anticipated final disposability of the passively safe waste"*.

9 Principle RSMDP11 states that radioactive substances should be stored using BAT, and the considerations to be applied include:

> *"The need to minimise degradation of the store and the substances stored"*.
> A further consideration in relation to this principle is that:
> *"Where radioactive wastes are being packaged, operators first need to demonstrate that the wastes being packaged will meet anticipated disposal requirements"*.

10 Principle RSMDP15 states that:

> *"Requirements and conditions that properly protect people and the environment should be set out and imposed for disposal of radioactive waste. Disposal of radioactive waste should comply with imposed requirements and conditions"*
> and makes clear that such requirements and conditions include waste receivers' conditions for acceptance.

11 In this report we assess the arguments and evidence provided by Westinghouse to show that the ILW and spent fuel from the operation and decommissioning of the AP1000 can all be processed into disposable forms using current techniques or developing techniques likely to be successful.

12 Westinghouse obtained and provided a view from the Radioactive Waste Management Directorate (RWMD) of the Nuclear Decommissioning Authority (NDA) (as the UK's authoritative source) on the disposability of their proposed arisings of ILW and spent fuel (NDA RWMD, 2009). Westinghouse provided the regulators with the NDA RWMD GDA Disposability Assessment reports for the

AP1000 in October 2009 (summary report), and January 2010 (part 1:main report and part 2:data sheets and inventory tables). Westinghouse provided an opinion of the RWMD assessment reports in October 2009 (Westinghouse, 2009a) which they placed on their public website for GDA.

13 We raised a Regulatory Observation (RO) RO-AP1000-60 (HSE and Environment Agency, 2009a) on Westinghouse during our assessment, with a Regulatory Observation Action (ROA) (HSE and Environment Agency, 2009b) requiring Westinghouse to provide further information on its case for disposability of spent fuel and ILW.

14 Westinghouse responded to the RO (Westinghouse, 2010), and we have taken account of its response in this assessment.

15 Our findings on the wider environmental impacts and waste management arrangements for the AP1000 reactor may be found in our Consultation Document (Environment Agency, 2010c).

3 Assessment

3.1 Basis for assessment

3.1.1 Environment Agency scrutiny of the GDF programme

16 The Environment Agency is responsible in England and Wales for regulating disposals of radioactive waste. The Nuclear Decommissioning Authority's Radioactive Waste Management Directorate (NDA/RWMD) is currently charged with a GDF to dispose of higher activity solid radioactive waste. The programme to implement the GDF will take many years. Our involvement falls into two categories: early engagement and advice; and formal regulatory permitting.

17 Prior to any formal application, our role is to provide advice. We have entered into an agreement with NDA to provide, and charge for, advice during the early stages of the development of a GDF. Our scrutiny of the work by RWMD during these early stages enables us to:

a) advise on the requirements for, and preparation of, future submissions to the regulators;

b) improve our understanding of the safety and environmental performance of proposals for the GDF and provide our views on improving safety and environmental protection;

c) provide guidance on regulatory issues that may arise;

d) inform stakeholders of our requirements;

e) inform RWMD of the work they will be required to carry out to meet our regulatory requirements during future stages;

f) reduce the risk of unnecessary expenditure or delays during the formal regulatory stages.

18 We will ensure that our advice to RWMD, or information provided in dialogue with stakeholders, during the early stages of developing a GDF will not compromise our independence. Any such advice does not alter our ability to make regulatory decisions in the future.

19 Any GDF in England or Wales will have to be designed and located so as to satisfy the Environment Agency that the environmental safety requirements specified in our guidance (Environment Agency and Northern Ireland Environment Agency, 2009) will be met. This will be the case for any GDF, whether or not its intended inventory includes ILW and/or spent fuel from new build nuclear power stations, but where they are intended to be part of the disposal inventory then this will need to be

taken into account in demonstrating that the requirements will be met. Part of this assessment of Westinghouse's disposability case is to consider, to the extent possible with the information currently available, whether the ILW and spent fuel from a fleet of AP1000s would necessitate any significant changes to the design of a GDF, and if so whether those changes are likely to be feasible without compromising the environmental safety of the facility. However, the environmental safety of any GDF, with whatever inventory it is to contain, will ultimately be determined through the due processes of regulatory scrutiny and decision making based on actual information about the site, facility and wastes to be accepted.

3.1.2 NDA/RWMD's Letter of Compliance (LoC) process

20 The overall objective of the LoC assessment process (NDA, 2008) is to give confidence to all stakeholders that the future management and disposal of waste packages has been taken into account as an integral part of their development and manufacture. This is achieved by the site operator working to NDA packaging standards and seeking input from RWMD to explicitly demonstrate that the waste packages produced by a proposed packaging process will be compliant with the generic waste package specification and compatible with plans for transportation to and emplacement in the planned future GDF.

21 This is achieved through production by RWMD of a comprehensive disposability safety assessment. This is produced following assessment of the proposed waste package against published safety assessment methodologies for transport, repository operations and repository post-closure.

22 In cases where the assessment has concluded that the waste package is compliant with the reference repository concept and underpinning assessments, RWMD is prepared to confirm this by the issue of a LoC.

23 The Environment Agency scrutinises the operation of the LoC process as part of its wider scrutiny of the GDF programme (see above).

24 Disposability assessments and LoC are generally issued at three stages during development of a waste retrieval and packaging plant: at the conceptual stage, interim stage and final stage prior to active operations. The provision of disposability assessments and LoCs at these stages are designed to support important commissioning stages in the waste conditioning project.

25 Plans for management of the ILW and spent fuel from future nuclear power stations have not yet reached even the conceptual stage, but obtaining a preliminary view of their likely disposability has been identified as an element of the generic design assessment (GDA) process. The RWMD disposability assessment for Westinghouse has therefore not been prepared as part of the LoC process, but has followed the same basic approach as is used for the LoC process.

3.1.3 Joint Guidance on the Management of Higher Activity Wastes

26 The relevant regulators (HSE, Environment Agency and SEPA) have issued joint guidance (HSE, Environment Agency and SEPA, 2010) on how nuclear licensees should manage higher activity wastes so as to satisfy regulatory requirements. This guidance recommends that licensees develop and maintain radioactive waste management cases (RWMCs) for all higher activity wastes, addressing the longer-term safety and environmental issues associated with the waste.

27 An important component of the RWMC relates to the conditioning of the radioactive waste. This is addressed through:

a) studies, such as best practicable environmental option (BPEO), to show how the conditioning option was selected and how it fits within an integrated waste strategy (IWS);

b) a description of what conditioning will be carried out on the waste, or the justification for storing the waste without conditioning;

c) considering disposability. A reasoned judgement must be provided on whether the conditioned waste meets the anticipated requirements for acceptance from a potential disposal site operator. Where a proposal is for storage of waste in an unconditioned form, a suitable outline of a proposed conditioning strategy for the waste should be included (this forms the basis for a suitable 'exit strategy' for producing a disposable package).

28 Other aspects that should be covered in RWMCs are:

a) possible deterioration of the waste during storage;

b) key constraints on how the waste will be managed in the future, such as storage conditions and monitoring requirements;

c) arrangements for preserving information that might be needed to ensure safety and environmental protection during the future management of the waste stream and to make sure the wastes can be accepted in a future long-term storage or disposal facility;

d) management, including disposal, of secondary radioactive waste arisings, especially those from the waste conditioning storage.

29 Disposability assessments and LoCs from NDA/RWMD will therefore typically be important sources of evidence for RWMCs. However the RWMC needs to present *the licensee's* whole case to demonstrate that they are applying good practice in managing their higher activity wastes. Regulatory acceptance or otherwise that a licensee is satisfying regulatory requirements will be based on the regulators' assessment of the RWMC in its entirety. Regulatory scrutiny of the LoC process allows the regulators to satisfy themselves of the reliability of disposability assessments and LoCs as evidence.

30 We do not expect Westinghouse to present fully developed RWMCs supported by LoCs as an output of the GDA process. We do expect them to identify at least one complete credible route by which the higher activity wastes from a fleet of AP1000s could be safely disposed of and to provide grounds for reasonable confidence that the route(s) could be followed successfully. We also expect that interactions through the course of the GDA process will comprehensively identify issues that will need to be addressed in the future programme. We anticipate provision of a developed plan demonstrating how these issues will be addressed and providing confidence in a successful outcome (e.g. likely to result in future LoC endorsement).

3.2 Assessment of Westinghouse's disposability case

31 Westinghouse have provided comments on NDA/RWMD's disposability assessment. We have considered the assessment report (NDA RWMD, 2009) and these comments (Westinghouse, 2009a) collectively as Westinghouse's disposability case, but it is clear that it has not been prepared as such. We expect Westinghouse to take ownership of the disposability case so that it unambiguously presents *its* arguments and evidence for the disposability of ILW and spent fuel from a fleet of AP1000s, with a plan showing how identified issues will be addressed. This may draw upon NDA/RWMD's assessment and conclusions as evidence but should present Westinghouse's case.

32 In particular, this case should:

a) be based on assumptions that Westinghouse consider to be appropriate;

b) indicate how and when Westinghouse intend to address outstanding issues, including those identified by NDA/RWMD (or, where appropriate, how and when they foresee a future licensee addressing them);

c) show how Westinghouse expect to arrive at a credible application for LoCs for ILW and spent fuel from a fleet of AP1000s, and give some assurance that RWMD will be adequately prepared to assess such an application.

33 We note that Westinghouse have subsequently clarified and demonstrated their ownership of the disposability case, as discussed below (see paras 48 et seq).

3.2.1 Storage of spent fuel

34 The disposability assessment is based on the assumption that all fuel elements will have a burn-up of 65 GWd/tU and will be stored for 90 years between discharge from the reactor and emplacement in the GDF[1]. HSE will indicate their requirements for a demonstration that safety can be assured during storage, possibly for significant timescales (e.g. 90 years). Since the disposability assessment assumes that this storage takes place, our view on disposability must be subject to such a demonstration being provided to HSE's satisfaction. We note the following:

a) RWMD have assumed in their assessment that fuel elements are manufactured with fresh uranium, and state explicitly that further assessment would be needed if recycled uranium were used.

b) The determining factor for the duration of storage might be availability of the GDF for emplacement rather than heat generation, that is the GDF might not be available to accept spent fuel from the AP1000 fleet as soon as the heat generation reaches an acceptable level. Therefore the necessary storage period could be longer than anticipated in the disposability assessment, and could be independent of assumptions about burn-up.

c) In effect the disposability assessment addresses whether the spent fuel discharged from the reactor would be disposable if the radioactive inventory and heat generation were reduced to the levels expected after 90 years. It will need to be demonstrated that the other physical and chemical characteristics of the fuel as it ultimately goes to the GDF will not differ sufficiently from those of the fuel discharged from the reactor as to invalidate the disposability assessment. Therefore, in addition to providing assurance to HSE that storage will be safe for the necessary duration, it will be necessary to demonstrate to us that the storage conditions and fuel characteristics are such that disposability of the fuel will not degrade to an unacceptable degree during that period of storage.

d) For example, the Instant Release Fractions (IRFs) assumed are clearly not derived from study of fuel that has been stored for 90 years after discharge from the reactor. We recognise that the IRFs assumed for fuel with a burn-up of 65 GWd/tU are potentially pessimistic for fuel with an average burn-up of less than 50 GWd/tU. To date, we have seen no evidence concerning whether IRFs could change in fuel over extended timescales. We are aware, for example, of arguments that IRFs may increase over time in closed systems due to diffusive processes (e.g. within packages in the disposal environment prior to groundwater ingress).

---

[1] Based on a reference case design involving spent fuel sealed in a durable container surrounded by bentonite. The constraints associated with such concepts (e.g. permissible package heat outputs) are yet to be fully evaluated.

35 Various potential arguments have been put forward to reduce the necessary duration of storage, including modifications to the GDF design, changes to fuel packaging assumptions, or simply applying a more realistic value for the average burn-up of fuel. Clearly, if the required storage period can genuinely be reduced, the importance of the concerns set out above would decrease to some extent, and the points might need to be reconsidered on their merits (bearing in mind that some of the suggested solutions might change other aspects of the assessment, e.g. by increasing the GDF footprint). In particular, using a realistic average burn-up as the basis for the assessment could reduce the expected storage period by about 20 years. This could make it marginally easier to make the necessary cases concerning storage, but we would not expect a step change as the storage period would still be relatively long.

36 Furthermore, if the storage period is determined by availability of the repository for disposal, then none of the arguments about heat generation are relevant and storage for the longer period would need to be assessed.

3.2.2 Conditioning options

37 At this stage of the GDA process, we would expect to see evidence that, for each of the higher activity waste streams, there is at least one identified conditioning route that could be relied upon with reasonable confidence to provide disposable waste packages. In the future, we would expect to see evidence that different conditioning options have been evaluated and proposals to apply the option(s) identified as optimal.

38 Given the similarity between ILW waste streams from the AP1000 and those from existing UK reactors, and between the conditioning proposed by Westinghouse and current UK practice, we agree with the positive assessment of disposability (indeed, we might have expected the proposed conditioning option to be described with greater confidence as “viable” rather than only “potentially viable”).

3.2.3 Critical assumptions whose validity will need to be confirmed

39 The assumption of a fleet of reactors sufficient to generate about 10 GW(e) is not necessarily bounding but seems a reasonable working assumption. Parts of the disposability assessment depend fairly strongly on this assumption. Clearly it may not be possible to confirm absolutely how many reactors might be built, and the current assumption is sufficient for the GDA process, but we note that definite decisions will be needed in due course as to the types and amounts of wastes and spent fuel that will be accepted by the GDF[2] as currently foreseen.

40 The additional risks posed by the ILW from a fleet of AP1000s are judged by RWMD to be small in the context of the total ILW inventory destined for the GDF. Furthermore, since RWMD’s generic assessment (based on a generic geology[3]) indicates risks well within regulatory criteria, particularly the post-closure risk guidance level of 10^{-6} per year, it is concluded that the risks will remain within regulatory criteria with the additional ILW from the AP1000s. However, RWMD’s generic assessment rests on many assumptions, by no means all of which have been demonstrated to be bounding. Indeed some assumptions are essentially specifications (albeit specifications judged by RWMD to be achievable) of what will

---

2 Or GDFs, if it is decided to develop separate facilities for different wastes, e.g. one for ILW and another for HLW/spent fuel.

3 Noting that the modelling parameters used to represent the generic geosphere are essentially calibrated against the risk guidance level, although it has been argued (by Nirex) that they are not unreasonable for UK geosphere.

need to be achieved for the GDF to meet regulatory criteria. These assumptions – or replacement assumptions that achieve the same outcome – will need to be confirmed in due course. More particularly, the arguments that the relatively large C-14 inventory assumed for the decommissioning ILW need not be a significant concern are rather speculative at this stage and will need to be underpinned more convincingly. We recognise that RWMD are unlikely to have markedly more confidence in their estimates of the risks associated with C-14 in repository-generated gases before a site for the GDF has been selected, by which time responsibility for the disposability case is likely to have transferred from Westinghouse to licensees. We will expect Westinghouse – and, subsequently, licensees – to keep themselves abreast of any developments in this regard as well as refining their projected C-14 inventories, so as to provide assurance as soon as possible that decommissioning ILW will be disposable.

41 Similarly, the assessed peak risk from disposal of spent fuel from the fleet of AP1000s is quoted as 3.2 10^{-7} y^{-1}. This projected risk from just one waste stream does not leave a large margin to the regulatory risk guidance level of 10^{-6} y^{-1}. We recognise that some assumptions within the post closure risk assessment are potentially bounding (e.g. a pessimistically high average burn up) or conservative (e.g. relatively short containment timescales associated with steel rather than copper containers, evolution rates of C-14 in mobile gaseous form from activated metal matrices). Other assumptions might not be bounding or conservative (e.g. the assumed groundwater return times, assumptions regarding the form in which C-14 might arise in the gas pathway). At the time of disposal it will need to be confirmed by the GDF licensee that the performance of the GDF with its whole inventory will be consistent with our risk guidance level.

42 Clarification will be needed of how and where the spent fuel will be packaged. The disposability assessment assumes that the consignor will package it before sending it to the GDF, and therefore that it will be transported in its disposal package. However, Westinghouse do not appear to have provided a description of how they will do it, and may have assumed that it will be packaged at the GDF, in which case the assessment of transportability would need to be based on unpackaged fuel. We note that options for packaging spent fuel have been discussed by Westinghouse in documents that we did not receive in time to include in this assessment. Furthermore, we acknowledge that it will not be Westinghouse's decision whether a spent fuel packaging plant is built at the GDF. Nevertheless, to be internally consistent, the disposability case would need to assume either packaging at the reactor site and transport packaged (in which case the packaging process should be included in the assessment) or packaging at the GDF site and transport unpackaged.

43 Assumptions about wastes to be disposed of as LLW will need to be confirmed in order to confirm the inventory requiring disposal as ILW. We discuss the evidence on LLW streams provided by Westinghouse to date in our Assessment Report AP1000-06 on solid radioactive waste (Environment Agency, 2010b).

3.2.4 Minor observations

44 Comparisons of waste volumes and other characteristics from an AP1000 fleet (and their potential effects on a GDF) with the corresponding information on the existing legacy may be legitimate and can provide useful context but are not indicators of the acceptability of the former.

45 The comparison between ILW streams from the AP1000 and from Sizewell B focuses on decommissioning ILW because this dominates the total activity of ILW. This is reasonable if the purpose of the comparison is only to consider inventory as an indicator of disposability. It is not clear, however, why a comparison of other aspects of the waste streams – such as waste volumes and material composition –

might not also provide some insight into disposability questions, in which case some comparison of operational ILW streams between the AP1000 and Sizewell B could be instructive. A superficial comparison with the 2007 UK Radioactive Waste Inventory suggests significant differences between the volumes of what appear from its descriptions to be similar waste streams.

46 The intention for disposing of the RCCAs will need to be clarified and explained in LoC submissions and in the RWMC. The disposability assessment reasonably indicates that they will not constitute a major addition to the overall inventory, and that they could be conditioned separately as ILW or disposed of with the rest of the fuel assembly.

3.3 Westinghouse's response to ROA-AP1000-60.A1

47 In Regulatory Observation Action RO-AP1000-60.A1 (HSE and Environment Agency, 2009b), the regulators requested Westinghouse to make a case for the disposability of spent fuel and ILW, which demonstrates the following:

a) How the issues identified in its critique of RWMD's Disposability Assessment will be addressed.

b) How the issues in Appendix B of RWMD's Disposability Assessment will be addressed.

c) How they will manage any risks associated with these issues

48 Westinghouse's response to this ROA is provided in Westinghouse letter reference WEC 000149, dated 22 February 2010 (Westinghouse, 2010), which we have reviewed. We recognise that, in most cases, the identified issues will need to be addressed by future operators of AP1000s, rather than by Westinghouse, and we note that Westinghouse have consulted with potential operators of the AP1000 on when they would expect to address issues. It might have been prudent also to discuss the timing of resolution of these issues with RWMD, to check how the planned timing fits with their usual expectations for the LoC process.

49 Westinghouse's response clarifies its case for the disposability of spent fuel and ILW as distinct from, but supported by, RWMD's disposability assessment. We welcome this clarification.

50 In general, we consider the plans proposed by Westinghouse to address – or, more commonly, for future licensees to address – outstanding disposability issues to be adequate at this stage. We will expect these plans to be periodically refined and updated in future to reflect developments.

51 We particularly note Westinghouse's plans to address the key issue of the long term storage of high burn-up spent fuel pending availability of a disposal facility and/or sufficient cooling of the fuel for its acceptance for disposal. The descriptions of these plans rightly focus on the issue of ensuring that the integrity of the fuel is maintained throughout whatever storage period is needed. However, we reiterate that we will also expect to see such plans address other aspects of ensuring that the fuel remains an acceptable waste form for disposal, such as any possible changes to the IRF arising from extended storage.

52 Similarly, while noting that Westinghouse propose using waste forms and containers that are endorsed by RWMD, we stress that procedures for storage of ILW prior to consignment to the GDF should address the continuing disposability of stored waste packages as well as the factors of "safety, transportability, stock control and ability to retrieve" referred to in Westinghouse's response.

53 We note that Westinghouse have produced "RWMC Evidence Reports" for HLW (including spent fuel treated as waste) (Westinghouse, 2009b) and for ILW (Westinghouse, 2009c). The reports are intended to indicate where the information

that will be needed for future RWMCs will come from, and when. These documents give us some assurance at this stage that RWMCs can be compiled at relevant stages in the development of an AP1000 fleet, which is sufficient at this stage of the GDA process. We note, however, that the RWMC Evidence Reports in their current form would not yet fully meet our expectations for the format and content of an RWMC.

4 Public comments

54 No comments on ILW were received from the public involvement process relating to the AP1000 design during our detailed assessment stage.

55 Public comments on spent fuel were received during our detailed assessment stage. One comment requested information about the type of spent fuel cask that would be used to transport spent fuel for processing or disposal. The response from Westinghouse was that the exact model of the spent fuel cask to transport spent fuel for processing or disposal has not yet been chosen. It should also be noted that RWMD have not yet provided any definitive specifications of acceptable waste packages for acceptance of spent fuel at a GDF. It is stated however that the cask selected will meet the requirements of IAEA and UK standards for design and construction. The cask chosen will have been shown to survive a sequence of four simulated accident conditions involving impact, puncture, fire and submersion in water. Both during and after the tests, the cask must contain the nuclear material, limit radiation doses to acceptable levels, and prevent a nuclear reaction.

5 Conclusions

56 Subject to a satisfactory demonstration that ILW and spent fuel can be stored safely for the necessary period of time without significant degradation, we see no reason at this stage to believe that any of the ILW or spent fuel from a fleet of nine AP1000s will not be disposable in a suitably designed and located GDF. We conclude that interactions through the course of the GDA process have identified a range of issues that will need to be addressed in the future programmes of Westinghouse and/or potential or actual licensees and we note the provisional plan as to how these issues will be addressed through future work. In due course, we will need to see more definitive assessments to confirm how all of the ILW and spent fuel will be conditioned for disposal, that the selected conditioning methods represent the application of BAT, and that in their conditioned forms the ILW and spent fuel will continue to be disposable.

57 The regulators need more information on the ILW's and spent fuel's potential for degradation over the longer term that might affect its disposability and safe storage. Westinghouse provided information on disposability in March 2010. The regulators have requested information about long term storage and this information is being provided. HSE is reviewing this information in their Step 4 assessment. We will continue to work with HSE on this, and this work will inform our decision document. Our conclusion is, therefore, subject to the potential GDA Issue and other issue:

Potential GDA Issue

a) Disposability of spent fuel following longer term interim storage pending disposal.

Other issue

b) Disposability of ILW following longer term interim storage pending disposal.

References

(Environment Agency, 2007)	Process and Information Document for Generic Assessment of Candidate Nuclear Power Plant Designs, Environment Agency, January 2007. http://publications.environment-agency.gov.uk/pdf/GEHO0107BLTN-e-e.pdf
(Environment Agency, 2010a)	Regulatory Guidance Series, No RSR 1: Radioactive Substances Regulation - Environmental Principles (REPs), 2010. http://publications.environment-agency.gov.uk/pdf/GEHO0709BQSB-e-e.pdf
(Environment Agency, 2010b)	GDA Assessment Report AP1000-06, Solid radioactive waste (LLW and ILW), May 2010.
(Environment Agency, 2010c)	Generic design assessment. AP1000 nuclear power plant design by Westinghouse Electric Company LLC. Consultation Document.
(Environment Agency and Northern Ireland Environment Agency, 2009)	Geological Disposal Facilities on Land for Solid Radioactive Wastes: Guidance on Requirements for Authorisation. http://www.environment-agency.gov.uk/business/sectors/99322.aspx
(HSE and Environment Agency, 2009a)	Regulatory Observation RO-AP1000-60: Disposability of spent fuel and ILW, 21 December 2009.
(HSE and Environment Agency, 2009b)	Regulatory Observation Action RO-AP1000-60.A1: The case for disposability of spent fuel and ILW, 21 December 2009.
(HSE, Environment Agency and SEPA, 2010)	The management of higher activity radioactive waste on nuclear licensed sites. http://www.hse.gov.uk/nuclear/wastemanage.htm#pt1
(NDA, 2008)	Letter of Compliance (LoC) Assessment Process, NDA Position Paper W&NM/PP/011 Issue 1. http://www.nda.gov.uk/documents/upload/WNM-PP-011-Letters-of-Compliance-LoC-Assessment-Process-1-January-2008.pdf
(NDA RWMD, 2009)	Generic Design Assessment: Disposability Assessment for Wastes and Spent Fuel arising from Operation of the Westinghouse Advanced Passive Pressurised Water Reactor (AP1000), NDA Document NXA/10897959 Issue 1, 11 November 2009.
(Westinghouse, 2009a)	Generic Design Assessment – Disposability Assessment for the Westinghouse Passive Pressurized Water Reactor (AP1000) – Westinghouse Electric Company Opinion, Letter from DM Popp to Joint Programme Office, WEC 00098, 19 October 2009.
(Westinghouse, 2009b)	UK AP1000 Radioactive Waste Management Case Evidence Report for High Level Waste UKP-GW-GL-056, Rev 0.
(Westinghouse, 2009c)	UK AP1000 Radioactive Waste Management Case Evidence Report for Intermediate Level Waste, UKP-GW-GL-055, Rev 0.

(Westinghouse, 2010) Regulatory Observation Actions for Regulatory Observations ROAP1000-60 and RO-AP1000-60.A1 – Disposability of spent fuel and ILW, Letter from DM Popp to Joint Programme Office, WEC 000149, 22 February 2010.

Abbreviations

BAT	Best available techniques
BPEO	Best practicable environmental option
GDA	Generic design assessment
GDF	Geological disposal facility
HLW	High level waste
HSE	The Health and Safety Executive
ILW	Intermediate level waste
IRF	Instant release fraction
IWS	Integrated waste strategy
LLW	Low level waste
LoC	Letter of Compliance
NDA	Nuclear Decommissioning Authority
P&ID	Process and information document
REPs	Radioactive substances environmental principles
RO	Regulatory observation
ROA	Regulatory observation action
RWMC	Radioactive waste management cases
RWMD	Radioactive Waste Management Directorate (of NDA)
SEPA	Scottish Environment Protection Agency
SNF	Spent nuclear fuel. That is fuel that has been irradiated in and permanently removed from a reactor core (IAEA)

Would you like to find out more about us, or about your environment?

Then call us on

08708 506 506* (Mon-Fri 8-6)

email

enquiries@environment-agency.gov.uk

or visit our website

www.environment-agency.gov.uk

incident hotline 0800 80 70 60 (24hrs)

floodline 0845 988 1188

***Approximate calls costs: 8p plus 6p per minute (standard landline). Please note charges will vary across telephone providers**

Environment first: This publication is printed on paper made from 100 per cent previously used waste. By-products from making the pulp and paper are used for composting and fertiliser, for making cement and for generating energy.