Generic design assessment

AP1000® nuclear power plant design by Westinghouse Electric Company LLC

Final assessment report

Integrated waste strategy

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Environment Agency
Horizon house, Deanery Road
Bristol BS1 5AH
Email: enquiries@environment-agency.gov.uk
www.environment-agency.gov.uk

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Generic design assessment

AP1000® nuclear power plant design by Westinghouse Electric Company LLC

Final assessment report – integrated waste strategy

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: 1.4 – a proposed waste and spent fuel strategy based on the expected waste generation and management practices throughout the facility lifecycle
Radioactive substances regulation environmental principles[2]	The following principles are relevant to this assessment: RSMDP1 - Radioactive substances strategy RSMDP3 - Use of BAT to minimise waste DEPD1 – Decommissioning strategy DEPD2 – Decommissioning plan DEDP3 – Considering decommissioning during design and operation
Report author	Price-Walter, S. J.

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 the AP1000®'s integrated waste strategy based on information submitted by Westinghouse in its environment report (ER) and supporting documents.

2 Our conclusions have been updated since our consultation as a result of additional information. Decommissioning is no longer the subject of a generic design assessment (GDA) Issue, but we have identified a new assessment finding on this subject.

3 **We have concluded that:**

a) **Westinghouse has provided a reasonable radioactive waste and spent fuel strategy for all waste streams that an AP1000 will typically produce.**

b) **The radioactive waste and spent fuel strategy is consistent with recent government statements (BERR, 2008a).**

c) **The AP1000 design facilitates decommissioning, and uses BAT to minimise decommissioning waste and the impacts on people and the environment of decommissioning operations.**

4 As part of our assessment, we identified the following assessment finding:

a) The future operator shall provide at the detailed design stage, an updated decommissioning strategy and decommissioning plan (UK AP1000-AF01).

5 Our findings on the wider environmental impacts and waste management arrangements for the AP1000 reactor may be found in our Decision Document (Environment Agency, 2011a).

2 Introduction

6 We originally published this report in June 2010 to support our GDA consultation on the AP1000 design. The consultation was on our preliminary conclusions. It began on 28 June 2010 and closed on 18 October 2010.

7 We received additional information from Westinghouse after June 2010 and also undertook additional assessment in response to consultation responses. This report is an update of our original report covering assessment undertaken between June 2010 and the end of March 2011 when Westinghouse published an update of their submission. Where any paragraph has been added or substantially revised it is in a blue font. It is noted that sections 3.4 and 3.5 have been completely rewritten.

8 Guidance on our GDA was published in January 2007 (process and information (P&I) document (Environment Agency, 2007)). Table 1, section 1.4 of the P&I document requires the requesting parties (RPs) to provide a proposed waste and spent fuel strategy based on the expected waste generation and management practices throughout the facility lifecycle. Table 1, section 1.4 of the P&I document states that:

'*A proposed waste and spent fuel strategy based on the expected waste generation and management practices throughout the facility lifecycle. This strategy should have regard to*

a) *the UK Government's sustainable development strategy (March 2005) Cm 6467 (Defra, 2005);*

b) *the objectives of the UK strategy for radioactive discharges 2001-2020, (DECC, 2009);*

c) *the review of radioactive waste management policy, final conclusions, Cm2919 July 1995 (DETR, 1995);*

d) *the decommissioning of the UK nuclear industry's facilities (decommissioning policy) (DTI, 2004);*

e) *our radioactive substances regulation environmental principles (REPs) (Environment Agency, 2010).*'

9 We expect new nuclear power plant designs to be developed in line with a radioactive waste and spent fuel strategy that seeks to:

a) minimise the production of radioactive waste;

b) manage unavoidable wastes and spent fuel so as to achieve an optimal level of protection for people and the environment.

10 Our radioactive substances regulation environmental principles (REPs) (Environment Agency, 2010) set out the issues that this type of strategy should take into account. For new nuclear power plant designs, the strategy also needs to be consistent with recent government statements (BERR, 2008a) that:

a) the disposal of intermediate level radioactive waste (ILW) to a future geological repository, from any new nuclear power stations, is unlikely to occur until late this century;

b) any nuclear power stations that might be built in the UK should proceed on the basis that spent fuel will not be reprocessed.

11 For decommissioning, in line with government policy (DECC, 2009), we expect:

a) the radioactive waste and spent fuel strategy to address decommissioning;

b) the design to use the best available techniques (BAT) to:

i) facilitate decommissioning;

ii) minimise arisings of decommissioning waste;

iii) minimise the impacts on people and the environment of decommissioning operations and the management of decommissioning waste.

12 We are carrying out our assessment in two stages:

a) preliminary assessment – we examine the outline details of the requesting party's submission to find out if further information is needed, if there are any issues that are obviously unacceptable, or if there needs to be any significant design modifications;

b) detailed assessment – we examine the submission in detail to decide initially if we might issue a statement of design acceptability. We will only make our final decision after we have consulted the public and considered the responses we receive.

13 Westinghouse submitted its AP1000 design for GDA in August 2007. We published the findings of our preliminary assessment in March 2008 (Environment Agency, 2008).

14 We found that the submission did not contain the level of information we needed to carry out a detailed assessment but Westinghouse committed to providing further information. In fact they provided a completely revised submission, its environment report (ER) with supporting documents. It has published the ER and other supporting documents on its website (http://www.ap1000.westinghousenuclear.com/).

15 Our detailed assessment of the information contained in the revised submission on integrated waste strategy (IWS) is documented within this assessment report. This is essentially the same as that provided in the first issue of this assessment report but updated, where appropriate, to reflect:

a) Our assessment of any further information provided by Westinghouse since the consultation date.

b) Any further work that we said, in the consultation document, that we intended to do.

c) Any matters arising from the Office for Nuclear Regulation's[1] (ONR's) GDA Step 4 work that are relevant to our assessment.

d) Our consideration of any consultation responses relevant to this topic.

e) Our consideration of any comments from our 6 July GDA stakeholder seminar relevant to this topic.

16 We also liaised with ONR on other matters of joint interest and used their Step 3 and Step 4 reports to inform our assessment.

17 It is noted that the assessment of spent fuel strategy and non-radioactive wastes are documented within other assessment reports (Environment Agency, 2011b and Environment Agency, 2011c).

18 Our findings on the wider environmental impacts and waste management arrangements for the AP1000 reactor may be found in our Decision Document (Environment Agency, 2011a).

19 We have published the consultation responses submitted in regard to our preliminary conclusions for the AP1000 design on our website (see: https://consult.environment-agency.gov.uk/portal/ho/nuclear/gda).

20 The questions raised at our stakeholder seminar have also been published (see: http://www.hse.gov.uk/newreactors/seminar-060710.pdf).

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[1] The Office for Nuclear Regulation (ONR) was created on 1st April 2011 as an Agency of the Health and Safety Executive (HSE). It was formed from HSE's Nuclear Directorate and has the same role. In this report we therefore generally use the term "ONR", except where we refer back to documents or actions that originated when it was still HSE's Nuclear Directorate.

3 Assessment

3.1 Assessment methodology and process

21 The basis of our assessment was to:

a) read appropriate sections of the ER and its supporting documents;

b) hold technical meetings with Westinghouse to clarify our understanding of the information presented and explain any concerns we had with that information;

c) raise Regulatory Observations (ROs) and Technical Queries (TQs) where we believed information provided by Westinghouse was insufficient;

d) carry out supporting site visits to gain knowledge to inform our decision;

e) assess the IWS provided by Westinghouse using our internal guidance and regulatory experience and decide if they minimise the production of radioactive waste and manage unavoidable wastes so as to achieve an optimal level of protection for people and the environment;

f) consider consultation responses and comments from our stakeholder seminar relevant to this topic;

g) decide on any GDA Issues or assessment findings to carry forward from GDA.

22 In undertaking our assessment, we have worked closely with ONR. We have also had discussions with other Regulators; the Radiation and Nuclear Safety Authority of Finland (STUK) and the United States Nuclear Regulatory Commission (NRC).

23 As detailed in our preliminary assessment report (Environment Agency, 2008), Westinghouse's submission received in August 2007 did not contain the level of information that was needed to carry out a detailed assessment on IWS. Therefore, as a result a Regulatory Issue (RI) was raised in February 2008.

24 In January 2009, Westinghouse provided additional information; revision 1 of its ER with supporting documents. We assessed information contained in the ER but found that while much improved from the original submission it still lacked detail on the IWS. Subsequently a joint Regulatory Observation (RO) was raised by the Environment Agency and ONR, requesting a standalone strategy for waste management.

25 In October 2009, Westinghouse submitted its IWS document.

26 In March 2010, Westinghouse provided an updated ER and supporting documents which included all the relevant information provided by its TQ and RO responses up until this date.

27 In December 2010, in response to two ROs we raised jointly with HSE, Westinghouse provided additional information on decommissioning and decontamination (see 'Westinghouse documentation' section below).

28 In December 2010, in response to a RO action we raised jointly with HSE, Westinghouse provided updated radioactive waste management case (RWMC) evidence reports for Intermediate Level Waste (ILW) and High Level Waste (HLW) that identify how their existing documentation forms the basis of a RWMC for the AP1000.

29 In March 2011, Westinghouse provided an updated ER and supporting documents (including an updated IWS and RWMC evidence reports for ILW and HLW) which included all the relevant information provided by its TQ and RO responses up until this date.

30 The following table provides information on the RI and ROs that were raised which are relevant to IWS:

RI/RO/TQ number and title	Reason for raising	Comments on response
RI-AP1000-0001 Information required by the Environment Agency for the detailed assessment stage	Limited information received in August 2007 submission.	Westinghouse provided a commitment (to which we assigned the unique number CM-AP1000-1) to provide information to comply with the P&I document requirements identified in the schedule to RI-AP1000-001 within several future submissions.
RO-AP1000-034 RO-AP1000-034.A01 RO-AP1000-034.A02 RO-AP1000-034.A03 RO-AP1000-034.A04: Integrated Waste Strategy	Limited information received in August 2007 submission and January 2009 information. Hence RO asked for a comprehensive IWS and documentary evidence that BAT has been used.	Documentation provided.
RO-AP1000-034.A05 Integrated Waste Strategy	RO action asked for an update to the RWMC which incorporates comments from the Regulators and a review of all relevant documents that had been submitted as part of GDA since the original document was submitted, and is in line with the updates to guidance on RWMCs (HSE et al, 2010).	In December 2010, Westinghouse provided updated 'evidence reports' for ILW and HLW that identify how its existing documentation forms the basis of a RWMC for the AP1000. In March 2011, Westinghouse provided us with another update of these documents.
RO-AP1000-087 RO-AP1000-087.A01 RO-AP1000-087.A02 RO-AP1000-087.A03 RO-AP1000-087.A04 RO-AP1000-087.A05 RO-AP1000-087.A06 RO-AP1000-087.A07 RO-AP1000-087.A08 Decommissioning	Limited information received in March 2010 ER and supporting documents. Hence RO asked for further information in the following areas: principles underpinning the design, decommissioning logistics, timings of decommissioning, hazards and challenges, assumed plant status at decommissioning, disposability assessment, decommissioning plans, and knowledge management.	In December 2010, Westinghouse provided a report on decommissioning (UN REG WEC 000465, Revised Response to Regulatory Observation RO-AP-1000-087 and Regulatory Observation Actions RO-AP1000-087.A1 to A7 – Decommissioning, 28/12/10). In March 2011, this was incorporated into a supporting document (UKP-GW-GL-795, UK AP1000 NPP Decommissioning Plan, Revision 0).

RI/RO/TQ number and title	Reason for raising	Comments on response
RO-AP1000-095 RO-AP1000-095.A01 RO-AP1000-095.A02 RO-AP1000-095.A03 RO-AP1000-095.A04 RO-AP1000-095.A05 Decontamination	Limited information received in March 2010 ER and supporting documents. Hence RO asked for further information in the following areas: decontamination during operations and maintenance, decontamination during POCO and decommissioning, laundry facilities, decontamination wastes, and knowledge management.	In December 2010, Westinghouse provided a report on decontamination (UN REG WEC, Westinghouse Response to Regulatory Observation RO-AP-1000-095 and Regulatory Observation Actions RO-AP1000-095.A1 to A4 – Decontamination, 09/11/10). In March 2011, this was incorporated into a supporting document (UKP-GW-GL-084, UK AP1000 Decontamination Considerations, Revision 0).

3.2 Assessment objectives

31 We started our assessment with some key questions to answer:

a) does the IWS cover all waste streams that an AP1000 will typically produce?

b) will the IWS optimally protect human health and the environment?

c) is the IWS consistent with government policy?

3.3 Westinghouse documentation

32 We referred to the following documents to produce this report:

Document reference	Title	Version number
UKP-GW-GL-790	UK AP1000 Environment Report	4
UKP-GW-GL-054	UK AP1000 Integrated Waste Strategy	1
UKP-GW-GL-026	AP1000 Nuclear Power Plant BAT Assessment	2
UKP-GW-GL-055	UK AP1000 Radioactive Waste Management Case Evidence Report for Intermediate Level Waste	2
UKP-GW-GL-056	UK AP1000 Radioactive Waste Management Case Evidence Report for High Level Waste	2
UKP-GW-GL-793	Pre-Construction Safety Report	0
EPS-GW-GL-700	European Design Control Document	1
UKP-GW-GL-795	UK AP1000 NPP Decommissioning Plan	0
UKP-GW-GL-084	UK AP1000 Decontamination Considerations	0

33 We use short references in this report, for example:

a) ER = Environment report;

b) IWS = AP1000 integrated waste strategy document.

3.4 Integrated waste strategy

34 Westinghouse's IWS outlines its current strategy for managing radioactive and non-radioactive waste, including spent fuel, arising from operations and decommissioning for the AP1000 reactor. The IWS does not include waste from construction activities. The IWS is a companion document to the UK AP1000 environment report (ER) and the radioactive waste management case (RWMC) evidence reports for ILW and HLW.

35 A schematic of the AP1000 reactor's waste management strategy can be found in Figure 3.5-1 of the ER.

36 Westinghouse's IWS states that it relates to all waste and all material that could become waste, both radioactive and non-radioactive. It claims in its IWS that the requirements of the waste management hierarchy are inherent in many aspects of the AP1000 design. It also claims that it has not identified any waste that is incompatible with current or developing disposal techniques.

37 Westinghouse claims in its ER that its IWS is consistent with the key BAT management factors for optimising releases from nuclear facilities shown in Table 3.1-1 in the ER. One of these factors stated by Westinghouse is to 'concentrate and contain environmentally persistent or bio accumulative emissions'. Features of the AP1000 design that address this factor have been added to Table 3.1-1 of the ER. (The 'concentrate and contain' option involves trapping the radioactivity in a solid, concentrated form for storage and eventual disposal rather than the 'dilute and disperse' option which involves the direct discharge of gaseous or liquid radioactivity into the environment, DECC, 2009a). The Institution of Mechanical Engineers (GDA146[2]) responded to our consultation saying that it fully supports the principle of 'concentrate and contain' as the preferred process for the radioactive waste strategy and consider this to be the most suitable option for future reactors. Stop Hinkley (GDA159) provided the following response: '*We applaud the preference for the principle of 'concentrate and contain' not 'dilute and disperse' referred to in paragraph 166. Unfortunately the text does not seem to receive ownership by the Environment Agency, who we believe should approach all radioactive waste issues with this as the primary principle rather than BAT or ALARP*'. We base our regulatory decisions on applying all the environmental principles set out in the 2009 Statutory Guidance (DECC, 2009a), one of which is: '*the preferred use of "concentrate and contain" in the management of radioactive waste over "dilute and disperse" in cases where there would be a definite benefit in reducing environmental pollution, provided that BAT is being applied and worker dose is taken into account*'. We note that it is not practical to capture all gaseous and aqueous waste streams, but we require BAT to minimise the radioactivity content of such discharges.

38 In 2006, the Government's response to recommendations by the Committee on Radioactive Waste Management (CoRWM), established that, in England and Wales, deep geological disposal is the preferred route for the long-term management of radioactive waste that is not suitable for near-surface disposal. It also gave the responsibility for implementing the programme for a deep geological repository to the Nuclear Decommissioning Authority (NDA). To take this into account, ONR, the Environment Agency and the Scottish Environment Protection Agency (SEPA) have developed a series of joint guidance documents on the management of higher activity

[2] We list the names of all the organisations that responded to the consultation in Annex 7 of the Decision Document (Environment Agency, 2011a). We have not given names of individuals or members of the public. The list gives a GDA number to each response (for example, GDA76 is for the Health & Safety Executive), so that the documents can be searched to allow all respondents to see where their responses have been considered. Where we quote consultation responses in this document, we have not corrected spelling or grammar.

radioactive waste (available at http://www.hse.gov.uk/nuclear/wastemanage.htm). These specify the production, content, maintenance and review of RWMCs. The RWMC should demonstrate the long-term safety and environmental performance of the management of higher activity radioactive waste from generation to conditioning into a form that will be suitable for storage and eventual disposal. Westinghouse provided two documents - one for ILW and one for HLW - that it claims demonstrate that suitable RWMCs can be prepared by the site licensee in the future. These documents were both updated by Westinghouse in December 2010, and again in March 2011 (see 'Westinghouse documentation' section).

39 Westinghouse states in its IWS that its strategy for LLW is to collect and transfer it to its radwaste building where it will be sorted and segregated and, wherever possible, decontaminated. It also states that the AP1000 design features and operating regimes will reduce the volumes of LLW generated. Westinghouse expects that the future utility operator will dispose of LLW to the LLWR.

40 Westinghouse states in its IWS that the AP1000 design minimises the production of ILW. Its strategy for dealing with ILW is to process the waste into a stable form using mobile facilities and then to store on-site in the ILW store. It will be disposed of to the ILW repository when it has been developed.

41 Westinghouse states in its IWS that its strategy relating to radioactive liquids is to treat them to reduce activity, using BAT as much as practicable, and to discharge to the environment following a suitable monitoring period.

42 Westinghouse states in its IWS that its strategy relating to radioactive gaseous discharges is to treat as much as practicable using AP1000 systems, and then to monitor and release to the environment. Stop Hinkley (GDA159) provided the following response to our consultation: '*We believe that even with the extra costs of high level protective gear that the industry should take every conceivable measure to incur no doses to the public*'. We note that our statutory guidance concerning the regulation of radioactive discharges into the environment (DECC, 2009a) has the following environment principle; optimisation of protection on the basis that radiological doses and risks to workers and members of the public from a source of exposure should be kept as low as reasonably achievable (the ALARA principle).

43 The ER is consistent with recent government statements (BERR, 2008a) as Westinghouse has stated in Section 3.5.8.2 that ILW will be stored on site until a national ILW repository becomes available.

44 The IWS takes into account statutory guidance concerning the regulation of radioactive discharges into the environment (DECC 2009a). In particular, Westinghouse has used the principle of 'concentrate and contain' in its AP1000 design.

45 Maldon Town Council (GDA59) commented that the waste strategy is not up to the specification of Magnox South, for example at Bradwell decommissioning standard. We do not expect the IWS to have the same level of detail as that of an existing plant or one that is undergoing decommissioning. However, we do expect the IWS to be reviewed and updated as necessary. We also recognise that the IWS will evolve with time and become more fully optimised as techniques and technologies improve.

46 Maldon Town Council (GDA59) also said that transporting this waste was not mentioned. We do not regulate the safe transport of radioactive material and hence we did not include this is our assessment and consultation.

47 Several respondents were concerned about the availability of a LLWR and a GDF. These responses are considered in chapter 10 of our decision document, and a GDF is also considered in chapter 11, and in Annex 8 of the AP1000 decision document (Environment Agency, 2011a).

48 Greenpeace (GDA152) responded that the consultation should be withdrawn and undertaken only when the waste management proposals become firm plans which

could be implemented. We have received credible plans which could be implemented if needed. This will be part of our site-specific assessment. We have concluded that for GDA, the radioactive waste strategy is reasonable for all waste streams that the AP1000 will typically produce and that it is consistent with recent government statements (BERR, 2008a).

49 At our stakeholder seminar, a question was asked whether any new wastes arise from the design. We have concluded from our assessment that the waste streams that the AP1000 will typically produce are similar to those from existing nuclear power plants.

50 Additionally, at our stakeholder seminar, the following comment was made on the AP1000 design: '*Evidence required to demonstrate that the design uses BAT. For instance visibility required on the process that has been undertaken to optimise radioactive waste minimisation and management facilities.*' Studsvik UK Ltd (GDA132) also commented that BAT needs to be applied to the waste treatment options as well. Westinghouse has published its submission on its website which includes the AP1000 BAT assessment, and the radioactive waste treatment options study report.

51 Several respondents, including; individual respondents (GDA26, GDA85), the Nuclear Technology Subject Group of the Institution of Chemical Engineers (GDA71), Springfields Site Stakeholder Group (GDA97), Horizon Nuclear Power (GDA128) and the Institution of Mechanical Engineers (GDA146) said that they were satisfied with our conclusions on the IWS. Springfields Site Stakeholder Group (GDA97) said that it assumes that the strategy is consistent with waste hierarchy principles. We confirm that it is.

52 Westinghouse UK (GDA110) said that it agreed with our preliminary conclusions and that it was committed to resolving any outstanding issues within the GDA process.

53 **We have concluded that:**

a) **Westinghouse has provided a reasonable radioactive waste strategy for all waste streams that an AP1000 reactor will typically produce.**

b) **The radioactive waste strategy is consistent with recent government statements (BERR, 2008a).**

3.5 Decommissioning specifics

54 Westinghouse claims that it has demonstrated the end of life activity of decommissioning, and has taken the current experience of decommissioning activities into account in the design and layout of the AP1000 in chapter 20 of its European DCD. It states that this enables the utility to develop a decommissioning strategy. In UKP-GW-GL-795, Revision 0, "UK AP1000 NPP Decommissioning Plan", March 2011, Westinghouse provides information on an AP1000 outline decommissioning plan. It claims that this plan demonstrates the technical and practical feasibility of one method by which the AP1000 can be easily decommissioned. Westinghouse also provides information on decommissioning and end of life aspects in Chapter 27 of its PCSR.

55 Westinghouse states in its IWS that, within the design of the AP1000, there are many features that facilitate the eventual decommissioning of the plant. For example:

a) Reduced equipment numbers reduce the amount of waste that needs managing.

b) Carefully selecting materials reduces activation of equipment and structure.

c) Reduction in activated corrosion products by improved control of primary circuit water chemistry and suitable dosing regimes; for example, zinc acetate.

56 We noted in our consultation document, that ONR were requesting further information from Westinghouse on decommissioning for consideration in its Step 4 assessment. We also expected further detailed evidence to be provided in GDA on

decommissioning, as this would assist any future operator in providing a Decommissioning and Waste Management Plan for agreement by the Department of Energy and Climate Change (DECC) Secretary of State (see BERR 2008b). Westinghouse provided this additional information in December 2010 (see 'Westinghouse documentation' section). We have assessed this additional information and have concluded that the design does consider the whole life-cycle of the AP1000, including decommissioning. The AP1000 design facilitates decommissioning, and uses BAT to minimise decommissioning waste and the impacts on people and the environment of decommissioning operations. We are therefore satisfied that decommissioning is no longer a GDA Issue. However, more detailed information will be required at the detailed design stage. We have therefore captured this as an assessment finding (UK AP1000-AF01).

57 We note that ONR has four assessment findings associated with the decommissioning of an AP1000. During GDA, ONR agreed that Westinghouse could defer the development of some aspects of decommissioning until a licensee had been identified. Therefore, three assessment findings are associated with the outstanding work. They are for the development of a set of decommissioning principles; to look at the possible affects of a delay in decommissioning; and to identify the potential hazards and challenges associated with decommissioning. The other assessment finding is to review the construction activities to identify any actions that could be taken during construction that would be beneficial to the decommissioning process. We support all of these assessment findings.

58 Westinghouse also provided us with additional information in December 2010 (see 'Westinghouse documentation' section) on decontamination which shows its decontamination strategy and the decontamination systems and techniques for deployment during operations, maintenance and decommissioning.

59 One of the questions raised at the stakeholder seminar, was whether the GDA process would capture decommissioning. We have addressed decommissioning and as mentioned above, since our consultation document was published, we have received further information on decommissioning from Westinghouse (see 'Westinghouse documentation' section).

60 Another question raised at the stakeholder seminar, was whether decommissioning was just a UK issue or has it been looked at in other countries. We have spoken to Regulators in other countries, for example STUK, ASN and NRC and they are also looking at decommissioning. For example, US NRC Regulatory Guide 4.21 states: '*Applicants for standard design certifications, standard design approvals, and manufacturing licenses …… shall describe in the application how facility design will minimize, to the extent practicable, contamination of the facility and the environment, facilitate eventual decommissioning, and minimize, to the extent practicable, the generation of radioactive waste.'* (See http://nrc-stp.ornl.gov/special/reg_guide4-21.pdf)

61 A further question raised at the stakeholder seminar, was: '*Is it fair to push the decommissioning issue onto regulatory parties when UK government is actually responsible for creating circumstances to all clear decommissioning strategy*'. We expect new plants to be designed taking account of the need to facilitate decommissioning. In accordance to our REP DEDP2, initial decommissioning plans should be prepared during the design and construction of new facilities.

62 We were also asked at our stakeholder seminar, to what extent has previous experience in radioactive waste management and decommissioning been taken into account. For GDA, we are only reviewing the information submitted by the RPs on the reactor designs, although Westinghouse has included learning from experience principles.

63 We were asked at our stakeholder seminar, whether the decommissioning assessment will look at the reuse of materials. In accordance with our REP DEDP1 on

decommissioning strategy, the strategy should incorporate the use of the best available techniques to minimise the generation of radioactive and non-radioactive wastes, particularly by re-using equipment, facilities and buildings, and by re-using or recycling materials. Therefore, we have looked at this in our assessment and concluded that Westinghouse has considered the reuse of materials.

64 Suffolk Coastal District Council (GDA165) responded to our consultation saying that it has confidence in the technical appraisals undertaken by both the Environment Agency and the Health and Safety Executive and it supports the overall conclusions of the GDA. However, it also said that there remain concerns about the lack of detailed evidence in respect of decommissioning and its likely impacts. Ingleby Barwick Town Council (GDA39) also provided a similar response, as it said that the preliminary conclusions are okay as far as they go at this time but further discussion needs to take place with Westinghouse on decommissioning as this issue will figure prominently in the nuclear debate. As mentioned above, since our consultation, we have received additional information from Westinghouse (see 'Westinghouse documentation' section) that we have reviewed and considered in making our decision.

65 Stop Hinkley (GDA159) provided the following response: '*We note the EA's intention in paragraph 195 to obtain more detailed information from EDF and AREVA on how exactly the EPR can be decommissioned safely. The outcome of the Magnoxes not being designed with decommissioning in mind is a long and fraught process for engineers, as discussed in the BNFL Magnox decommissioning dialogues, attended by Stop Hinkley*'. Stop Hinkley noted their response is focused on the EPR design but that this point would apply equally to the AP1000 design.

66 Horizon Nuclear Power (GDA128) provided the following response: '*We appreciate that the EA's conclusions on decommissioning in the consultation document are focussed on the design of the AP1000 and it is right and proper that Westinghouse should respond to this aspect since this is under their full control. However, we are also aware that the EA has requested information from Westinghouse about decommissioning that goes beyond the reactor design and impinges on the operational issues associated with decommissioning. We believe it is important to draw the distinction between generic, site specific and operational issues and that each of these should be considered at the appropriate stage of the relevant licensing and permitting processes during the lifetime of the project. We note that decommissioning of the AP1000 has been identified as a potential GDA Issue. E.ON KernKraft and RWE Power (the subsidiary companies of our parent companies E.ON AG and RWE AG respectively) are currently undertaking several large-scale reactor decommissioning projects in Germany. Their experience shows that decommissioning of a PWR is actually more of a management than a technical challenge. Providing that good housekeeping is maintained during operations, experience shows that it will be possible to undertake decommissioning in an efficient and effective manner. We would hope that the EA's continuing work will conclude that decommissioning is not a GDA Issue. All of the technologies required to perform decommissioning of modern PWRs in a safe, reliable and efficient manner are available today and are being deployed in active decommissioning projects. Good design of modern PWRs will make decommissioning easier and it is appropriate that reactor vendors expend considerable resources to ensure that reactors built to their designs can be efficiently and effectively decommissioned. Experience in Germany has demonstrated that the key to a successful decommissioning project is for the operator to plan carefully the logistics of how the available technologies are deployed in practice. Whilst the detailed design of the PWR itself can aid decommissioning*, it is not necessarily the primary contributor to a successful project.' We asked for information in accordance with our REPs on decommissioning. We agree that the operator will have a key role to play throughout the operation of the reactor and during decommissioning to minimise the waste produced from decommissioning. Hence, the operator shall update the decommissioning strategy and plan throughout the lifecycle of the nuclear power plant.

67 The Institution of Mechanical Engineers (GDA146) responded to our consultation with

the following comment: '*Whilst the Institution agrees that a high level Decommissioning Strategy is required at this stage and design features to aid decommissioning must be considered and implemented, it is unreasonable to expect too much detail at this stage. As the operating life of the station will be 60 years much experience will be gained and new techniques will emerge during this period*.'

68 The Nuclear Technology Subject Group of the Institution of Chemical Engineers (GDA71) notes our reservation (in our consultation document) on decommissioning the AP1000 is understandable. It commented that uncertainty around the decommissioning strategy also presents an issue which is likely to undermine arguments to secure public acceptability.

69 Westinghouse UK (GDA110) said that it agrees with our preliminary conclusions and that it is committed to resolving any outstanding issues within the GDA process.

70 We asked for additional information from Westinghouse on decommissioning (which, as mentioned above, it provided after the consultation document was issued), but not detailed plans in accordance with our REPs on decommissioning and our guidance on GDA (Environment Agency, 2007). We have assessed this additional information and we are satisfied that the AP1000 can be decommissioned in an environmentally acceptable manner. We have concluded that decommissioning is no longer a GDA Issue.

71 **We conclude that the AP1000 design facilitates decommissioning, and uses BAT to minimise decommissioning waste and the impacts on people and the environment of decommissioning operations. However, the future operator shall provide at the detailed design stage, an updated decommissioning strategy and decommissioning plan (UK AP1000-AF01).**

3.6 Supporting visits

72 The ER and supporting documents identify a number of options for operating the AP1000 that are relevant to our assessment of the IWS. However, the prospective operator will choose the actual method of operation. Therefore, to help substantiate the claims made about the different methodologies, we made a number of site visits.

73 During GDA, with ONR we visited operational reactors and radioactive waste management facilities in France, Germany, Sweden, UK and USA. On these sites, the operation of the waste management facilities, training and maintenance facilities, decommissioning activities, spent fuel pool operations and mobile plant was observed. We have used the knowledge gained to inform our assessment for the AP1000.

74 The visits were successful in establishing that different operational approaches can be successfully implemented.

3.7 Compliance with our REPs

75 The following REPs were considered in our assessment of Westinghouse's IWS:

a) Principle RSMDP1 – Radioactive substances strategy: A strategy should be produced for the management of all radioactive substances;

b) Principle RSMDP3 – Use of BAT to minimise waste: The best available techniques should be used to ensure that production of radioactive waste is prevented and where that is not practicable minimised with regard to activity and quantity.

c) DEPD1 – Decommissioning strategy: Each site should have a decommissioning strategy that is updated and refined at appropriate intervals.

d) DEPD2 – Decommissioning plan: There should be a decommissioning plan for each facility and this should be updated and refined throughout its operating life and during decommissioning.

e) DEDP3 – Considering decommissioning during design and operation: Facilities should be designed, built and operated using the best available techniques to minimise the impacts on people and the environment of decommissioning operations and the management of decommissioning wastes.

76 The table below summarises whether these REPs have been addressed in Westinghouse's submission:

REP number	REP title	Information in submission
RSMDP1	Radioactive substances strategy	See description in 'Integrated waste strategy' section above. This shows that Westinghouse has provided a reasonable radioactive waste strategy for all waste streams that an AP1000 will typically produce.
RSMDP3	Use of BAT to minimise waste	Westinghouse has provided a reasonable radioactive waste strategy for all waste streams that an AP1000 will typically produce. The radioactive waste strategy is consistent with recent government statements (BERR, 2008a).
DEDP1	Decommissioning strategy	See description in 'Decommissioning specifics' section above. Westinghouse has described a decommissioning strategy, however we expect the future operator shall, at the detailed design stage, provide an updated decommissioning strategy and decommissioning plan (AP1000-AF01).
DEDP2	Decommissioning plan	See description in 'Decommissioning specifics' section above. Westinghouse has provided an initial decommissioning plan, however we expect the future operator shall, at the detailed design stage, provide an updated decommissioning strategy and decommissioning plan (AP1000-AF01).
DEDP3	Considering decommissioning during design and operation	See description in 'Decommissioning specifics' section above. Westinghouse has considered decommissioning in its AP1000 design.

3.8 Compliance with Table 1 in our Process and Information Document

77 Section 1.4 in Table 1 of the P&I document was considered in our assessment of Westinghouse's IWS. The table below summarises whether these requirements have been addressed in Westinghouse's submission:

Section number	Description of requirement	Information in submission
1.4	A proposed waste and spent fuel strategy based on the expected waste generation and management practices throughout the facility lifecycle.	See description in 'Integrated waste strategy' section above. This shows that Westinghouse has provided a reasonable radioactive waste strategy for all waste streams that an AP1000 will typically produce. The ER is consistent with recent government statements (BERR, 2008a) as Westinghouse has stated in section 3.5.8.2 that ILW will be stored on site until a national ILW repository becomes available. The IWS takes into account statutory guidance (DECC, 2009a) concerning the regulation of radioactive discharges into the environment. In particular, Westinghouse has used the principle of 'concentrate and contain' in its AP1000 design. See description in 'Decommissioning specifics' section above. This shows that the design does consider the whole life-cycle of the AP1000, including decommissioning, however we expect the future operator shall, at the detailed design stage, provide an updated decommissioning strategy and decommissioning plan (AP1000-AF01).

4 Public comments

78 The public involvement process remained open during our detailed assessment stage (see http://www.hse.gov.uk/newreactors/publicinvolvement.htm). We did not receive any public comments on the IWS by this route.

79 Responses made to our public consultation for the AP1000 design in regard to our preliminary conclusions on the IWS are considered herein and in our decision document, where relevant.

5 Conclusion

80 Our conclusions have been updated since our consultation as a result of additional information. Decommissioning is no longer the subject of a generic design assessment (GDA) Issue, but we have identified a new assessment finding on this subject.

81 **We have concluded that:**

a) **Westinghouse has provided a reasonable radioactive waste and spent fuel strategy for all waste streams that an AP1000 will typically produce.**

b) **The radioactive waste and spent fuel strategy is consistent with recent**

government statements (BERR, 2008a).

c) **The AP1000 design facilitates decommissioning, and uses BAT to minimise decommissioning waste and the impacts on people and the environment of decommissioning operations.**

82 As part of our assessment, we identified the following assessment finding:

a) The future operator shall provide at the detailed design stage, an updated decommissioning strategy and decommissioning plan (UK AP1000-AF01).

83 We note that ONR has an assessment finding on knowledge management. Successful waste management and decommissioning requires accurate information to be available to the operator and the decommissioning team. Therefore, this finding requires the operator to develop the necessary systems to achieve this. We support this assessment finding and this is in line with our REPs.

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While every effort has been made to ensure the accuracy of the references listed in this report, their future availability cannot be guaranteed.

Abbreviations

ASN	Autorité de sûreté nucléaire - The Nuclear Safety Authority of France
AP1000®	AP1000 is trademark of Westinghouse Electric Company LLC
BAT	Best available techniques
CoRWM	Committee for Radioactive Waste Management
DCD	Design control document
ER	UK AP1000 environment report
ERs*.*	Environment report section reference e.g. 3.2.2.2
GDA	Generic design assessment
HSE	The Health and Safety Executive
ILW	Intermediate level waste
IWS	AP1000 integrated waste strategy document
LLW	Low level waste
LLWR	Low level waste repository
NDA	Nuclear Decommissioning Authority
NLFAB	Nuclear Liabilities and Financial Assurance Board
NRC	The United States Nuclear Regulatory Commission
ONR	Office for Nuclear Regulation, an Agency of the HSE (formerly HSE's Nuclear Directorate)
PCSR	Pre-construction safety report
P&I	Process and information
REPs	Radioactive substances environmental principles
RI	Regulatory issue
RO	Regulatory observation
RWMC	Radioactive waste management cases
RWMD	Radioactive Waste Management Directorate (of NDA)
SEPA	Scottish Environment Protection Agency
STUK	The Radiation and Nuclear Safety Authority of Finland
TQ	Technical query
WEC	Westinghouse Electric Company LLC

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