

**Generic design assessment
AP1000 nuclear power plant design by
Westinghouse Electric Company LLC**

**Assessment report
Integrated waste strategy**



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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

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Generic design assessment

AP1000 nuclear power plant design by Westinghouse Electric Company LLC

Assessment report – integrated waste strategy

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|---|--|
| Protective status | This document contains no sensitive nuclear information or commercially confidential information. |
| Process and information document¹ | 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 principles² | The following principles are relevant to this assessment: RSMDP1 - Radioactive substances strategy RSMDP3 - Use of BAT to minimise waste |
| Report author | Saffron Price-Walter |

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>

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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 We also have concluded that:

- a) Westinghouse has provided a reasonable radioactive waste strategy for all waste streams that an AP1000 will typically produce.
- b) The radioactive waste strategy is consistent with recent government statements (BERR, 2008a).

3 We also conclude that we require further detailed information on how the AP1000 is designed to facilitate decommissioning, minimise decommissioning waste and minimise the impacts on people and the environment of decommissioning operations. We will continue to work with the Health and Safety Executive (HSE) on this as part of its Step 4 assessment, and this work will inform our decision document. Therefore, our conclusion is subject to the following potential Generic Design Assessment (GDA) Issue:

- a) Decommissioning of the AP1000.

2 Introduction

4 Guidance on our generic design process (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, 2010a)."

5 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.

6 Our radioactive substances regulation environmental principles (REPs) (Environment Agency, 2010a) 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.
- 7 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.
- 8 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.
- 9 Westinghouse submitted its AP1000 design for GDA in August 2007. We published the findings of our preliminary assessment in March 2008 (Environment Agency, 2008).
- 10 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. They have published the ER and other documents on its website (<http://www.ap1000.westinghousenuclear.com/>).
- 11 Our detailed assessment of the information contained in the revised submission on integrated waste strategy is documented within this assessment report. It is noted that the assessment of spent fuel strategy and non-radioactive wastes are documented within other assessment reports (Environment Agency, 2010b and Environment Agency, 2010c).
- 12 Our findings on the wider environmental impacts and waste management arrangements for the AP1000 reactor may be found in our Consultation Document (Environment Agency, 2010d).

3 Assessment

3.1 Assessment methodology and process

13 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) assess the integrated waste strategy 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;
- e) decide on any GDA Issues or other issues to carry forward from GDA.

14 In undertaking our assessment, we have worked closely with HSE. 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).

15 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 integrated waste strategy. Therefore, as a result a Regulatory Issue (RI) was raised in February 2008.

16 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 integrated waste strategy. Subsequently a joint Regulatory Observation (RO) was raised by the Environment Agency and HSE, requesting a standalone strategy for waste management.

17 In October 2009, Westinghouse submitted its IWS document.

18 The following table provides information on the RI and RO that were raised which are relevant to integrated waste strategy:

| 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. |

| RI/RO/TQ number and title | Reason for raising | Comments on response |
|---|--|-------------------------|
| 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 integrated waste strategy and documentary evidence that BAT has been used. | Documentation provided. |

3.2 Assessment objectives

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

- a) does the integrated waste strategy cover all waste streams that an AP1000 will typically produce?
- b) will the integrated waste strategy optimally protect human health and the environment?
- c) is the integrated waste strategy consistent with government policy?

3.3 Westinghouse documentation

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

| Document reference | Title | Version number |
|--------------------|--|----------------|
| UKP-GW-GL-790 | UK AP1000 Environment Report | 3 |
| UKP-GW-GL-054 | UK AP1000 Integrated Waste Strategy | 0 |
| UKP-GW-GL-026 | AP1000 Nuclear Power Plant BAT Assessment | 1 |
| UKP-GW-GL-055 | UK AP1000 Radioactive Waste Management Case Evidence Report for Intermediate Level Waste | 0 |
| UKP-GW-GL-056 | UK AP1000 Radioactive Waste Management Case Evidence Report for High Level Waste | 0 |
| UKP-GW-GL-732 | Pre-Construction Safety Report | 2 |
| EPS-GW-GL-700 | European Design Control Document | 1 |

21 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

- 22 Westinghouse's integrated waste strategy (IWS) outlines its current strategy for managing radioactive and non-radioactive waste, including spent fuel arising from operations and decommissioning for the AP1000. The IWS does not include waste from construction activities. The IWS is a companion document to the UK AP1000 environment report and the radioactive waste management case (RWMC) evidence reports for ILW and high level waste (HLW).
- 23 A schematic of the AP1000 waste management strategy can be found in Figure 3.5-1 of the ER.
- 24 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.
- 25 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. (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)).
- 26 In 2006, the Government's response to recommendations by the Committee for 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, HSE, the Environment Agency and the Scottish Environment Protection Agency (SEPA) have developed a series of joint guidance documents on the management of higher activity radioactive waste (available at <http://www.hse.gov.uk/nuclear/wastemanage.htm>). These specify the production, content, maintenance and review of radioactive waste management cases (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.
- 27 Westinghouse states in its IWS that its strategy for low level waste (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 low level waste repository (LLWR).
- 28 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 onsite in the ILW store. It will be disposed of to the ILW repository when it is has been developed.
- 29 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.

- 30 Westinghouse states in its IWS that its strategy relating to radioactive gaseous discharges is to treat as much as practicable using AP1000 systems, to monitor and release to the environment.
- 31 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.
- 32 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.

3.5 Decommissioning specifics

- 33 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 design control document (DCD). It states that this enables the utility to develop a decommissioning strategy. Appendix 20A of the European DCD provides information on an AP1000 outline decommissioning plan. Westinghouse 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 16 of its pre-construction safety report (PCSR).
- 34 Westinghouse states in its IWS that, within the design of 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.
- 35 We note HSE are requesting further information from Westinghouse on decommissioning for consideration in its Step 4 assessment. We also expect 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 DECC Secretary of State (see BERR 2008b).

3.6 Compliance with our REPs

- 36 The following REPs were considered in our assessment of Westinghouse's integrated waste strategy:
- 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.

37 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). |

3.7 Compliance with Table 1 in our Process and Information Document

38 Section 1.4 in Table 1 of the P&I document was considered in our assessment of Westinghouse’s integrated waste strategy. 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. | <p>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.</p> <p>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.</p> <p>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.</p> <p>See description in ‘Decommissioning Specifics’ section above. We note HSE are requesting further information from Westinghouse on decommissioning for consideration in its Step 4 assessment. We also expect further detailed evidence to be provided in GDA on decommissioning.</p> |

4 Public comments

39 No relevant public comments were received on this subject during our detailed assessment stage.

5 Conclusion

40 We have concluded that:

- a) Westinghouse has provided a reasonable radioactive waste strategy for all waste streams that an AP1000 will typically produce.
- b) The radioactive waste strategy is consistent with recent government statements (BERR, 2008a).

41 We also conclude that we require further detailed information on how the AP1000 is designed to facilitate decommissioning, minimise decommissioning waste and minimise the impacts on people and the environment of decommissioning operations. We will continue to work with HSE on this as part of its Step 4 assessment, and this work will inform our decision document. Therefore, our conclusion is subject to the following potential GDA Issue:

- a) Decommissioning of the AP1000.

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Generic design assessment. AP1000 nuclear power plant design by Westinghouse Electric Company LLC. Consultation Document

Abbreviations

| | |
|---------|--|
| 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 |
| 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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