Generic design assessment

UK EPR™ nuclear power plant design by AREVA NP SAS and Electricité de France SA

Final assessment report

Integrated waste strategy

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UK EPR™ nuclear power plant design by AREVA NP SAS and Electricité de France SA

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

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1 Summary

1 This report presents the findings of our assessment of the UK EPR™ integrated waste strategy based on information submitted by EDF and AREVA in their Pre-Construction Environmental Report (PCER) 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) **EDF and AREVA have provided a reasonable radioactive waste and spent fuel strategy for all waste streams that a UK EPR will typically produce.**

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

c) **The UK EPR 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 findings:

a) The future operator shall, at the detailed design stage, identify any changes to the 'reference case' for solid radioactive waste and spent fuel strategy, and provide evidence that the site-specific integrated waste strategy (IWS) achieves the same objectives (UK EPR-AF01).

b) The future operator shall, at the detailed design stage, provide an updated decommissioning strategy and decommissioning plan (UK EPR-AF02).

5 Our findings on the wider environmental impacts and waste management arrangements for the UK EPR 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 UK EPR 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 EDF and AREVA 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 EDF and AREVA 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 process was published in January 2007 (process and information document (P&ID) (Environment Agency, 2007)). Table 1, section 1.4 of the P&ID 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&ID 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, 2009b);*

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 matters 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, 2009b), 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 EDF and AREVA submitted their UK EPR design for GDA in August 2007. We published the findings of our preliminary assessment in March 2008 (Environment Agency, 2008). We found that the submission did not contain the level of information we needed to carry out a detailed assessment but EDF and AREVA committed to providing further information. In fact they provided a completely revised submission, their pre-construction environmental report (PCER) with supporting documents. They have published the PCER and other supporting documents on their website (http://www.epr-reactor.co.uk).

14 Our detailed assessment of the information contained in the revised submission on 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 EDF and AREVA 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.

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

16 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).

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

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

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

[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

20 The basis of our assessment was to:

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

b) hold technical meetings with EDF and AREVA 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 EDF and AREVA was insufficient;

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

e) assess the IWS provided by EDF and AREVA 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.

21 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).

22 As detailed in our preliminary assessment report (Environment Agency, 2008), EDF and AREVA'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.

23 In November 2008, EDF and AREVA provided additional information; a Pre-Construction Environmental Report (PCER) with supporting documents. We assessed information contained in the PCER 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.

24 In September 2009, EDF and AREVA submitted their IWS document.

25 In March 2010, EDF and AREVA provided an updated PCER and supporting documents which included all the relevant information provided by their TQ and RO responses up until this date.

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

27 In January 2011, in response to a RO action we raised jointly with HSE, EDF and AREVA provided an updated 'mapping document' that identifies how their existing documentation forms the basis of a radioactive waste management case (RWMC) for the UK EPR. This document was updated again and provided to us in March 2011.

28 In March 2011, EDF and AREVA provided an updated PCER and supporting documents which included all the relevant information provided by their TQ and RO responses up until this date.

29 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-EPR-0001 Information required by the Environment Agency for the detailed assessment stage	Limited information received in August 2007 submission.	EDF and AREVA provided a commitment (to which we assigned the unique number CM-EPR-1) to provide information to comply with the P&I document requirements identified in the schedule to RI-EPR-001 within several future submissions.
RO-EPR-033 RO-EPR-033.A01 RO-EPR-033.A02 RO-EPR-033.A03 RO-EPR-033.A04 Integrated Waste Strategy	Limited information received in August 2007 submission and November 2008 information. Hence RO asked for a comprehensive IWS and documentary evidence that BAT has been used.	Documentation provided but the radioactive waste strategy is a 'reference case' based on the waste and spent fuel management practices and arrangements of the UK EPR reference plant at Flamanville 3 so changes to the 'reference case' for solid radioactive waste and spent fuel strategy, for the site-specific strategy and evidence that the site-specific strategy achieves the same objectives shall be provided at the detailed design phase.
RO-EPR-033.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 January 2011, EDF and AREVA provided an updated 'mapping document' that identifies how their existing documentation forms the basis of a RWMC for the UK EPR. This document was updated again and provided to us in March 2011.

RI/RO/TQ number and title	Reason for raising	Comments on response
RO-EPR-067 RO-EPR-067.A01 RO-EPR-067.A02 RO-EPR-067.A03 RO-EPR-067.A04 RO-EPR-067.A05 RO-EPR-067.A06 RO-EPR-067.A07 RO-EPR-067.A08 Decommissioning	Limited information received in March 2010 PCER 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 November 2010, EDF and AREVA provided a report on decommissioning (UKEPR-0016-001, GDA UK EPR – Decommissioning, Revision 00). In March 2011, we were provided with an update of this document (Revision 01).
RO-EPR-077 RO-EPR-077.A01 RO-EPR-077.A02 RO-EPR-077.A03 RO-EPR-077.A04 RO-EPR-077.A05 Decontamination	Limited information received in March 2010 PCER 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, EDF and AREVA provided a report on decontamination (EPR70227R, RO-UKEPR-77 – Decontamination, 01/12/10). In March 2011, this was incorporated into a supporting document (UKEPR-0017-001, Decontamination Processes and Techniques for the UK EPR, Revision 00).

3.2 Assessment objectives

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

a) does the IWS cover all waste streams that a UK EPR will typically produce?

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

c) is the IWS consistent with government policy?

3.3 EDF and AREVA documentation

31 The PCER is divided into chapters and sub-chapters (provided as separate documents) and has supporting documents. We referred to the following documents to produce this report:

Document reference	Title	Version number
UKEPR-0003-050	PCER – Chapter 5 – Design principles related to decommissioning	04
UKEPR-0003-080	PCER – Chapter 8 – Best Available Techniques	02
UKEPR-0003-110	PCER – Chapter 11 – Radiological impact assessment	02
UKEPR-0003-120	PCER – Chapter 12 – Non radiological impact assessment	02
UKEPR-0011-001	GDA UK EPR-BAT Demonstration (EPRB)	04
UKEPR-0010-001	GDA UK EPR – Integrated Waste Strategy Document	02
NESH-G/2008/en/0123	Solid Radioactive Waste Strategy Report (SRWSR)	A
UKEPR-0012-001	Mapping Document for Radioactive Waste Management Case	02
UKEPR-0017-001	Decontamination Processes and Techniques for the UK EPR	00
UKEPR-0016-001	GDA UK EPR – Decommissioning	01

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

a) PCER sub-chapter 6.2 section 1.2.1 = PCERsc6.2s1.2.1;

b) BAT demonstration section 3.2 = EPRBs3.2.

3.4 Integrated waste strategy

33 EDF and AREVA's IWS outlines their current strategy for managing radioactive and non-radioactive waste, including spent fuel arising from the construction, operation and decommissioning of the UK EPR. The strategy is supported by:

a) a BAT assessment in the PCER (Chapter 8);

b) radionuclide specific BAT assessment reports in the EPRB;

c) impact assessments in the PCER (Chapters 11 and 12).

34 EDF and AREVA present a 'reference case' for solid radioactive waste and spent fuel strategy based on the waste and spent fuel management practices and arrangements of the reference plant for the UK EPR at Flamanville 3. In addition, since potential UK EPR operators may wish to adopt alternative spent fuel and waste management arrangements, other possible options to the reference case are presented in a solid radioactive waste strategy report (SRWSR). EDF and AREVA state in the IWS that the SRWSR does not provide respective BAT assessments for the options, but they have a high degree of confidence that such cases can be made by potential UK EPR operators.

35 EDF and AREVA claim in their IWS that there is a management strategy for all waste streams produced by the UK EPR and that their proposals minimise the amount of

waste produced by adhering to the waste hierarchy and BAT. They also claim that there are adequate controls to manage unavoidable waste and spent fuel to achieve an optimal level of protection for people and the environment. EDF and AREVA claim that all waste that cannot be reused or recycled is disposable.

36 EDF and AREVA state in their IWS that when considering the options for treatment of individual waste streams, the preferred approach used for the UK EPR design involved considering the balance between gaseous and aqueous discharges, and the generation of solid waste, while favouring a strategy of '*concentrate and contain*'. (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 that involves the direct discharge of gaseous or aqueous radioactivity into the environment (DECC, 2009a)). The Institution of Mechanical Engineers (GDA145[2]) responded to our consultation saying that it supports the principle of '*concentrate and contain*' as the preferred process for the radioactive waste strategy. Stop Hinkley (GDA157) 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.

37 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, 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. EDF and AREVA have provided a mapping document that identifies how their existing documentation forms the basis of a RWMC for the UK EPR. This was updated by EDF and AREVA in January 2011 (see 'EDF and AREVA documentation' section).

38 EDF and AREVA state in their IWS that solid radioactive waste arisings from the management of discharges are optimised. Solid radioactive waste will be disposed of as soon as practicable where an appropriate disposal route is available. The operator will dispose of LLW to the low level waste repository (LLWR) and ILW to the geological disposal facility (GDF) when it is available. In the interim, ILW will be stored on site in a dedicated building(s).

[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.

39 EDF and AREVA state in their IWS that their strategy for the management of aqueous radioactive waste for the reference case is based on:

a) minimising the production of effluents at source;

b) optimum use of segregation and effluent treatment systems;

c) optimum use of suitable storage systems for the site.

40 EDF and AREVA state in their IWS that their management strategy to limit radioactive gaseous discharges from the operating activities of the UK EPR is based on the design of the plant and the operational practices to be implemented. They claim that they will use BAT to minimise gaseous discharges at source and similarly in abatement plant, and balance worker doses and costs incurred during treatment in the plant with public doses from discharges. Stop Hinkley (GDA157) 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).

41 The IWS is consistent with recent government statements (BERR, 2008a) as EDF and AREVA have made provision in the design for ILW to be stored on site until the GDF is available for its disposal.

42 The IWS takes into account statutory guidance concerning the regulation of radioactive discharges into the environment (DECC, 2009a). In particular, as EDF and AREVA have used the principle of '*concentrate and contain*' in their UK EPR design.

43 Maldon Town Council (GDA51) 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.

44 Maldon Town Council (GDA51) also commented that EDF and AREVA seem to want to dispose of waste as soon as possible. We require that radioactive wastes are safely disposed of, at appropriate times and in appropriate ways and for GDA, we conclude that EDF and AREVA's strategy is reasonable. Government policy (Cm2919) states that: '*In preparing programmes and plans for the management of operational LLW, there should be a presumption by the waste manager towards management solutions which can be implemented early rather than late. Early solutions does not necessarily equate to early disposal. For example, decay storage of wastes pending final disposal is perfectly acceptable provided that the decay storage provides a genuine benefit. The objective should be to put such solutions in place prior to the implementation of those programmes and plans wherever possible. Where this is shown not to be possible, or inappropriate, any interim management of these wastes will need to be conducted in a manner that is acceptable to Regulators, and that takes account of the agreed final disposal route(s) identified from the options' assessments.*' (DETR, 1995)

45 Maldon Town Council (GDA51) 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 in our assessment and consultation.

46 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 Annex 8 of the UK EPR decision document (Environment Agency, 2011a).

47 Greenpeace (GDA151) 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 UK EPR will typically produce, and that it is consistent with recent government statements (BERR, 2008a).

48 Studsvik UK Ltd (GDA131) commented that BAT needs to be applied to the waste treatment options as well. As stated above, EDF and AREVA present a 'reference case' for solid radioactive waste and spent fuel strategy based on the waste and spent fuel management practices and arrangements of the reference plant for the UK EPR at Flamanville 3. In addition, since potential UK EPR operators may wish to adopt alternative spent fuel and waste management arrangements, other possible options to the reference case are presented in the SRWSR. EDF and AREVA state in the IWS that the SRWSR does not provide respective BAT assessments for the options, but they have a high degree of confidence that such cases can be made by potential UK EPR operators. To ensure the plans and strategies of future operators are optimised, we have included the assessment finding below.

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 UK EPR will typically produce are similar to those from existing nuclear power plants.

50 Several respondents, including; individual respondents (GDA25, GDA84), the Nuclear Technology Subject Group of the Institution of Chemical Engineers (GDA67), Springfields Site Stakeholder Group (GDA96), Sellafield Ltd (GDA126), Horizon Nuclear Power (GDA127) and the Institution of Mechanical Engineers (GDA145) said that they were satisfied with our conclusions on the IWS. Springfields Site Stakeholder Group (GDA96) said that it assumes that the strategy is consistent with waste hierarchy principles. We confirm that it is.

51 **We have concluded that:**

a) **EDF and AREVA have provided a reasonable radioactive waste strategy for all waste streams that a UK EPR will typically produce.**

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

52 **The radioactive waste strategy is a 'reference case' based on the waste and spent fuel management practices and arrangements of the reference plant for the UK EPR, Flamanville 3. The reference case is reasonable, however we expect the future operator shall, at the detailed design stage, identify any changes to the 'reference case' for solid radioactive waste and spent fuel strategy, and provide evidence that the site-specific IWS achieves the same objectives (UK EPR-AF01).**

3.5 Decommissioning specifics

53 EDF and AREVA's UK EPR decommissioning strategy is described in Chapter 5 of the PCER. This chapter includes the measures adopted at the design stage to facilitate decommissioning. Further information on decommissioning, including dismantling methodologies considered for the UK EPR and decontamination techniques, are in the solid radioactive waste strategy report (SRWSR).

54 The SRWSR states that the UK EPR design will enable decommissioning to be performed to minimise radiation doses to the workers and minimise radioactive waste generation. The SRWSR discusses the following features that have been incorporated into the design:

a) choice of materials of construction to minimise activation;

b) optimisation of neutron shielding;

c) optimisation of access routes to nuclear areas;

d) reactor systems design;

e) ease of removal of major process components;

f) submerged disassembly of reactor pressure vessel;

g) modular thermal insulation;

h) fuel cladding integrity;

i) design for decontamination;

j) prevention of contamination spread;

k) minimisation of hazardous materials.

55 We noted in our consultation document, that ONR were requesting further information from EDF and AREVA 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). EDF and AREVA provided this additional information in November 2010 (see 'EDF and AREVA documentation' section). We have assessed this additional information and have concluded that the design does consider the whole life-cycle of the UK EPR, including decommissioning. The UK EPR 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 EPR-AF02).

56 We note that ONR has an assessment finding 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 this assessment finding.

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

58 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 EDF and AREVA.

59 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)

60 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.

61 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 EDF and AREVA have included learning from experience principles.

62 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 EDF and AREVA have considered the reuse of materials.

63 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. As mentioned above, since our consultation, we have received additional information from EDF and AREVA that we have reviewed and considered in making our decision.

64 Stop Hinkley (GDA157) 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*'.

65 Horizon Nuclear Power (GDA127) provided the following response: '*We appreciate that the EA's conclusions on decommissioning in the consultation document are focussed on the design of the EPR and it is right and proper that AREVA and EDF should respond to this aspect since this is under their full control. However, we are also aware that the EA has requested information from AREVA and EDF 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.

66 The Institution of Mechanical Engineers (GDA145) responded to our consultation with the following two comments:

a) *'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.'*

b) *'The Institution acknowledges that the SRWSR states that the UK EPR design will enable decommissioning to be performed to minimise radiation doses to the workers and minimise radioactive waste generation. The SRWSR also discusses the several features that have been incorporated into the design to aid decommissioning. We await further clarifications as required by the EA during step 4 of the GDA and during the site specific submission to the Regulators.'*

67 The Nuclear Technology Subject Group of the Institution of Chemical Engineers (GDA67) noted that our reservation (in our consultation document) on decommissioning the UK EPR is understandable. It commented that uncertainty around the decommissioning strategy also presents an issue which is likely to undermine arguments to secure public acceptability.

68 We asked for additional information from EDF and AREVA on decommissioning (which, as mentioned above, they 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 UK EPR can be decommissioned in an environmentally acceptable manner. We have concluded that decommissioning is no longer a GDA Issue.

69 **We conclude that the UK EPR 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, at the detailed design stage, provide an updated decommissioning strategy and decommissioning plan (UK EPR-AF02).**

3.6 Supporting visits

70 The PCER and supporting documents identify a number of options for operating the UK EPR 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.

71 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 UK EPR.

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

3.7 Compliance with our REPs

73 The following REPs were considered in our assessment of EDF and AREVA'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.

74 The table below summarises whether these REPs have been addressed in EDF and AREVA's submission:

REP number	REP title	Information in submission
RSMDP1	Radioactive substances strategy	See description in 'Integrated waste strategy' section above. This shows that EDF and AREVA have provided a reasonable radioactive waste strategy for all waste streams that a UK EPR will typically produce.
RSMDP3	Use of BAT to minimise waste	EDF and AREVA have provided a reasonable radioactive waste strategy for all waste streams that a UK EPR will typically produce. The radioactive waste strategy is consistent with recent government statements (BERR, 2008a). The radioactive waste strategy is a 'reference case' based on the waste and spent fuel management practices and arrangements of the UK EPR reference plant at Flamanville 3. The 'reference case' is reasonable, however we expect the future operator shall, at the detailed design stage, identify any changes to the 'reference case' for solid radioactive waste and spent fuel strategy, and provide evidence that the site-specific IWS achieves the same objectives (UK EPR-AF01).
DEDP1	Decommissioning strategy	See description in 'Decommissioning specifics' section above. EDF and AREVA's have described a decommissioning strategy, however we expect the future operator shall, at the detailed design stage, provide an updated decommissioning strategy and decommissioning plan (UK EPR-AF02).

REP number	REP title	Information in submission
DEDP2	Decommissioning plan	See description in 'Decommissioning specifics' section above. EDF and AREVA have 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 (UK EPR-AF02).
DEDP3	Considering decommissioning during design and operation	See description in 'Decommissioning specifics' section above. EDF and AREVA have considered decommissioning in their UK EPR design.

3.8 Compliance with Table 1 in our Process and Information Document

75 Section 1.4 in Table 1 of the P&I document was considered in our assessment of EDF and AREVA's IWS. The table below summarises whether these requirements have been addressed in EDF and AREVA'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 EDF and AREVA have provided a reasonable radioactive waste strategy for all waste streams that a UK EPR will typically produce. The radioactive waste strategy is a 'reference case' based on the waste and spent fuel management practices and arrangements of the UK EPR reference plant at Flamanville 3. The 'reference case' is reasonable, however we expect the future operator shall, at the detailed design stage, identify any changes to the 'reference case' for solid radioactive waste and spent fuel strategy, and provide evidence that the site-specific IWS achieves the same objectives (UK EPR-AF01). The IWS is consistent with recent government statements (BERR, 2008a) as EDF and AREVA have made provision in the design for ILW to be stored on site until the GDF is available for its disposal. The IWS takes into account statutory guidance (DECC, 2009a) concerning the regulation of radioactive discharges into the environment. In particular as EDF and AREVA have used the principle of 'concentrate and contain' in their UK EPR design. See description in 'Decommissioning specifics' section above. This shows that the design does consider the whole life-cycle of the UK EPR, including decommissioning, however we expect the future operator shall, at the detailed design stage, provide an updated decommissioning strategy and decommissioning plan (UK EPR-AF02).

4 Public comments

76 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.

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

5 Conclusion

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

79 **We have concluded that:**

a) **EDF and AREVA have provided a reasonable radioactive waste and spent fuel strategy for all waste streams that a UK EPR will typically produce.**

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

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

80 As part of our assessment, we identified the following assessment findings:

a) The future operator shall, at the detailed design stage, identify any changes to the 'reference case' for solid radioactive waste and spent fuel strategy, and provide evidence that the site-specific IWS achieves the same objectives (UK EPR-AF01).

b) The future operator shall, at the detailed design stage, provide an updated decommissioning strategy and decommissioning plan (UK EPR-AF02).

81 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
BAT	Best available techniques
CoRWM	Committee on Radioactive Waste Management
EPRB	GDA UK EPR – BAT demonstration, document UKEPR-0011-001
EPRB 3.5s1.2	EPRB form 3.3 section 1.2 (example reference)
ETB	Effluent treatment building (this is also referred to as the 'Waste Treatment Building')
GDA	Generic design assessment
GDF	Geological disposal facility
HSE	The Health and Safety Executive
ILW	Intermediate level waste
IWS	GDA UK EPR – Integrated waste strategy document UKEPR-0010-001
LLW	Low level waste
LLWR	The national Low level waste repository, near Drigg, Cumbria
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)
P&I	Process and information
PCER	Pre-construction environmental report
PCERsc3.3s4.1	PCER sub-chapter 3.3 section 4.1 (example reference)
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
SRWSR	Solid radioactive waste strategy report
STUK	Säteilyturvakeskus - The Radiation and Nuclear Safety Authority of Finland
TQ	Technical query

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