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

Assessment report
Integrated waste strategy

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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
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 UK EPR's integrated waste strategy based on information submitted by EDF and AREVA in their Pre-Construction Environmental Report (PCER) and supporting documents.

2 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).

3 We conclude that we require further detailed evidence on how the UK EPR is designed to facilitate decommissioning, minimise decommissioning waste and minimise the impacts on people and the environment from 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 final decision. Therefore, our conclusion is subject to the following potential Generic Design Assessment (GDA) Issue:

a) Decommissioning of the UK EPR.

4 Our conclusion is also subject to the following other issue:

a) The changes to the 'reference case' for the site-specific strategy and evidence that the site-specific strategy achieves the same objectives shall be provided at site- specific permitting.

2 Introduction

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

6 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.

7 Our radioactive substances regulation environmental principles (REPs) (Environment Agency, 2010a) 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.

8 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.

9 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.

10 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).

11 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 documents on their website (http://www.epr-reactor.co.uk).

12 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).

13 Our findings on the wider environmental impacts and waste management arrangements for the UK EPR reactor may be found in our Consultation Document (Environment Agency, 2010d).

3 Assessment

3.1 Assessment Methodology and Process

14 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) assess the integrated waste strategy 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;

e) decide on any GDA Issues or other issues to carry forward from GDA.

15 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).

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

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

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

19 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-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.

RI/RO/TQ number and title	Reason for raising	Comments on response
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 integrated waste strategy 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 the site-specific strategy and evidence that the site-specific strategy achieves the same objectives shall be provided at site- specific permitting.

3.2 Assessment Objectives

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

a) does the integrated waste strategy cover all waste streams that a UK EPR 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 EDF and AREVA Documentation

21 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	03
UKEPR-0003-080	PCER – Chapter 8 – Best Available Techniques	01
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	03
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	Radioactive Waste Management Case	00

22 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

23 EDF and AREVA's integrated waste strategy (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).

24 EDF and AREVA present a 'reference case' 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.

25 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.

26 EDF and AREVA state in their IWS that when considering the options for treatment of individual waste steams, the preferred approach used for the UK EPR design involved considering the balance between gaseous and liquid 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 liquid radioactivity into the environment (DECC, 2009a)).

27 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 (Defra, 2006). 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 they claim identifies how their existing documentation forms the basis of a RWMC for the UK EPR (see UKEPR-0012-001 (Radioactive Waste Management Case)).

28 EDF and AREVA state in their IWS that solid radioactive waste will be optimised and this waste will be disposed of as soon as practicable where an appropriate disposal route is available. EDF and AREVA will dispose of low level waste (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).

29 EDF and AREVA state in their IWS that their strategy for the management of liquid 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.

30 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.

31 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.

32 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.

3.5 Decommissioning Specifics

33 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 detailed information on decommissioning, including dismantling methodologies considered for the UK EPR and decontamination techniques, are in the SRWSR.

34 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.

35 We note HSE are requesting further information from EDF and AREVA 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 EDF and AREVA'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 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 but changes to the 'reference case' for the site-specific strategy and evidence that the site-specific strategy achieves the same objectives shall be provided at site-specific permitting.

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 EDF and AREVA's integrated waste strategy. 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 but changes to the 'reference case' for the site-specific strategy and evidence that the site-specific strategy achieves the same objectives shall be provided at site-specific permitting. 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. We note HSE are requesting further information from EDF and AREVA on decommissioning for consideration in its Step 4 assessment. We also expect further detailed evidence to be provided in GDA on decommissioning.

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) 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).

41 However, we conclude that we require further detailed evidence on how the UK EPR 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 UK EPR

42 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 our conclusion is subject to the following other issue:

a) The changes to the 'reference case' for the site-specific strategy and evidence that the site-specific strategy achieves the same objectives shall be provided at site-specific permitting.

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Abbreviations

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
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 issue 00
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
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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