Generic design assessment

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

Final assessment report

Solid radioactive waste (LLW and ILW)

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Protective status	This document contains no sensitive nuclear information or commercially confidential information.
Process and information document[1]	The following sections of Table 1 in our process and information document are relevant to this assessment: 2.1 – a description of how radioactive wastes will arise, be managed and disposed of throughout the facility's lifecycle 2.4 – design basis estimates and substantiation of annual arisings of solid radioactive waste during operation and decommissioning 1.5 – an analysis should be provided that includes an evaluation of options considered and shows that the best available techniques will be used to minimise the production and discharge or disposal of waste
Radioactive substances regulation environmental principles[2]	The following principles are relevant to this assessment: RSMDP3 - Use of BAT to minimise waste RSMDP8 - Segregation of wastes RSMDP9 – Characterisation RSMDP10 – Storage RSMPD15 - Requirements and conditions for disposal of wastes
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™ solid radioactive waste (low level waste (LLW) and intermediate level waste (ILW)) based on information submitted by EDF and AREVA in their Pre-Construction Environmental Report (PCER) and supporting documents.

2 Our conclusions are unchanged since our consultation, however, we have reworded our assessment findings and added additional ones on; arisings of LLW and ILW, and incineration of ILW.

3 **We conclude that:**

a) **EDF and AREVA have identified all low level waste (LLW) and intermediate level waste (ILW) waste streams that a UK EPR will typically produce.**

b) **The UK EPR uses BAT to minimise the arisings of LLW and ILW, subject to assessment finding UK EPR-AF11.** Prior to consultation we only proposed an assessment finding relating to the disposal of LLW and ILW (UK EPR-AF12, below).

c) **The UK EPR uses BAT to treat and condition LLW and ILW prior to disposal, subject to assessment finding UK EPR-AF12.**

d) **The UK EPR is not expected to produce LLW or ILW for which there is no foreseeable disposal route.**

e) **EDF and AREVA have provided valid estimates for the annual arisings (during operations and decommissioning) of LLW and ILW. These arisings (during operations) are consistent with those of comparable reactors around the world (Isukul, 2009).**

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

a) The future operator shall provide confidence that adequate radioactive waste management cases (RWMCs), supported by appropriate stage Letters of Compliance (LoCs), can be developed for all intermediate level waste (ILW) on the timescales identified in EDF and AREVA's plan for disposability of ILW. (UK EPR-AF10)

b) The future operator shall provide evidence during the detailed design phase that the proposed specific techniques for preventing and, where that is not possible, minimising the creation of low level waste (LLW) and intermediate level waste (ILW) are the best available techniques (BAT). (UK EPR-AF11)

c) The future operator shall provide evidence during the detailed design phase that the proposed specific techniques for treating and conditioning of low level waste (LLW) and intermediate level waste (ILW) before disposal are the best available techniques (BAT). (UK EPR-AF12)

d) If smelting of any low level waste (LLW) is pursued, the future operator shall demonstrate that the conditions of acceptance of the selected smelting facility can be met. (UK EPR-AF13)

e) If incineration of any low level waste (LLW) is pursued, the future operator shall demonstrate that the conditions of acceptance of the selected incineration facility can be met. (UK EPR-AF14)

f) If incineration of any intermediate level waste (ILW) is pursued, the future operator shall demonstrate that the conditions of acceptance of the selected incineration facility can be met. (UK EPR-AF15).

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, 3.5 and 3.6 have been completely rewritten.

8 Guidance on our generic design assessment (GDA) process was published in January 2007 (process and information document (P&ID) (Environment Agency, 2007)). Table 1, section 2.1 of the P&ID requires the requesting parties (RPs) to provide a description on how radioactive waste will arise, be managed and disposed of throughout the facility's lifetime. Table 1, section 2.1 of the P&ID states that:

'*A description of how radioactive wastes will arise, be managed and disposed of throughout the facility's lifecycle. This should include:*

a) *sources of radioactivity and matters which affect wastes arising;*

b) *gaseous, liquid and solid wastes;*

c) *discharge points for gaseous wastes and discharge routes for liquid wastes;*

d) *disposal routes for solid wastes (including any proposals for incineration of combustible waste).*'

9 Table 1, section 2.4 of the P&ID requires the RPs to propose design basis estimates and substantiation of annual arisings of solid radioactive waste. Table 1, section 2.4 of the P&ID states that:

> '*Design basis estimates and substantiation of annual arisings of solid radioactive waste during operation and decommissioning. Wastes should be identified in terms of category (high level waste (HLW), ILW, LLW), physico-chemical characteristics and proposed disposal route (if any). Quantification should be in terms of activity of key individual radionuclides and overall groupings of radionuclides (e.g. total alpha), mass and volumes.*
>
> *The requesting party should obtain, and provide, a view from the Nuclear Decommissioning Authority (NDA) (as the UK authoritative source in providing such advice) on the disposability of any proposed arisings of ILW or HLW.*'

This P&ID requirement includes all radioactive wastes arisings, including those from operations and decommissioning, and includes waste arising from all activities, both routine and reasonably foreseeable non-routine activities (e.g. breakdown maintenance). This information is required:

a) in support of the waste and spent fuel strategy and BAT analysis which is the subject of P&ID requirements 1.4, 1.5 and 2.1;

b) in support of the assessment of the impact of any proposed direct disposal of waste (for example by on-site incineration);

c) to provide a basis for indicative limit setting where appropriate;

d) to provide confidence that wastes will not be generated for which there is no foreseeable disposal route.

10 Table 1, section 1.5 of the P&ID requires the RPs to provide an analysis that includes an evaluation of options considered and show that BAT will be used to minimise the production and discharge or disposal of waste. Table 1, section1.5 of the P&ID states that:

> '*An analysis should be provided that includes an evaluation of options considered and shows that the best available techniques will be used to minimise the production and discharge or disposal of waste. This should include:*
>
> – *a description of the means used by each significant waste generating and management process to minimise waste arising and discharged or disposed of and a demonstration that these are the best practicable;*
>
> – *a review of design features, including those of fuel usage, such as burn-up and rating, that facilitate minimisation of arisings and disposal of waste during operation of the reactor;*
>
> – *a review of design features that facilitate decommissioning and minimise the arisings of decommissioning waste.*
>
> *Reference should be made to:*
>
> – *all periods of "operation", for example at power, shutdown, maintenance and refuelling (including related tasks such as fuel and flask handling);*
>
> – *transitory periods (e.g. returning to power following shutdown);*
>
> – *issues relating to minimising radioactivity source terms (for example materials of construction and coolant chemistry);*
>
> – *abatement issues (for example optimising resin types and usage in treatment systems);*
>
> – *process control and monitoring arrangements including fault detection;*
>
> – *the selection of materials and physical features to minimise activation and contamination, facilitate decontamination, removal of components etc;*
>
> – *practices at other existing and proposed facilities.*'

11 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.

12 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).

13 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).

14 Our detailed assessment of the information contained in the revised submission on solid radioactive waste (low level waste (LLW) and intermediate level waste (ILW))

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[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 matters of joint interest and used their Step 3 and Step 4 reports to inform our assessment.

16 The assessment of disposability of ILW is the subject of a separate assessment report (Environment Agency, 2011d). The assessment of spent fuel and non-radioactive wastes are also 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) review 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 techniques proposed by EDF and AREVA to prevent and minimise production of solid radioactive waste using our internal guidance and regulatory experience;

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

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 LLW and ILW. 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 some aspects of LLW and ILW arisings. Subsequently, two Regulatory Observations (ROs) were raised jointly by the Environment Agency and ONR; one requesting a standalone strategy for waste management and the other a disposability case for spent fuel and ILW.

24 Additionally, several TQs were also raised.

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 December 2010, EDF and AREVA provided further information on waste conditioning in response to some queries raised by ONR as part of its Step 4 assessment.

27 In January 2011, in response to a RO action we raised jointly with ONR, 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 January 2011, in response to a RO action we raised jointly with ONR, EDF and AREVA provided further information on their plan for disposability of ILW which includes the plan for long-term storage and the work being undertaken by the Radioactive Waste Management Directorate (RWMD).

29 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.

30 The following table provides information on the RI, ROs and TQs that were raised which are relevant to LLW and ILW:

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&ID 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 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 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.
RO-EPR-039 RO-EPR-039.A01 RO-EPR-039.A02 RO-EPR-039.A03: Long Term Waste (Including Spent Fuel) Storage	The Regulators consider that EDF and AREVA should provide a plan showing when waste management facilities will be developed and constructed over the lifetime of a UK EPR.	The response to this RO was considered in our assessment report on disposability of ILW and spent fuel (Environment Agency, 2010b).
RO-EPR-48 RO-EPR-048.A01 Disposability of Spent Fuel and ILW	The Regulators consider that EDF and AREVA should show how and when the matters identified in the radioactive waste management directorate disposability assessments will be addressed.	The response to this RO was considered in our assessment report on disposability of ILW and spent fuel (Environment Agency, 2010b).

RI/RO/TQ number and title	Reason for raising	Comments on response
RO-EPR-048.A02 Consolidation of the plan for disposability of waste and spent fuel	RO action asked for the consolidation of the plan produced in response to RO-UKEPR-48 for disposability of waste and spent fuel to include the plan for long-term storage and the work being undertaken by RWMD.	In January 2011, EDF and AREVA provided further information on their plan for disposability of ILW which includes the plan for long-term storage and the work being undertaken by RWMD (EPR70238R, RO-UKEPR-48 A.2 – Consolidation of the plan for disposability of waste and spent fuel, 14/01/11).
TQ-EPR-149: EPR Environment Design Review and Environment Committee	Limited information on BAT received in August 2007 submission and November 2008 information. Hence TQ asked for documentation from the 'EPR Environment' design review held in 2004 and minutes from the 'Environment Committee'.	Documentation provided.
TQ-EPR-163: EPR Decommissioning LLW	EDF and AREVA's agreement in principle from the low level waste repository (LLWR) only covered operational LLW. Hence, TQ asked for confirmation that decommissioning waste will also be disposable.	Response states there is no reason for decommissioning wastes to be radiologically different to those in operation. Also, at the time of decommissioning, the availability of the current LLWR facility is questionable so the statement that completing the form D1s has limited value is reasonable.
TQ-EPR-162: EPR LLW Proposed for Incineration	EDF and AREVA outline options for incineration of LLW in their November 2008 information. Hence, TQ asked them to identify the available incinerators and provide evidence that the LLW proposed is within the conditions for acceptance (CFA).	No evidence on how the fingerprint / chemical make-up of the waste proposed to be incinerated meets the CFA of currently available incinerators. Hence TQ-EPR-341 was raised for waste oils.
TQ-EPR-341: Disposability of EPR Waste Oils	No information received in August 2007 submission and November 2008 information. Hence, TQ asked for waste category and management arrangements for waste oils and if incineration is proposed, evidence that waste can meet the relevant incinerator's CFA.	Justification provided that oil can go to a French incinerator. Also, confidence provided that oil can go to a UK one.
TQ-EPR-159: Solid Radioactive	The data provided in the November 2008 PCER is	No justification given that using the best quartiles for solid

RI/RO/TQ number and title	Reason for raising	Comments on response
Waste Estimates	based on an estimate that EDF and AREVA assume is a significant reduction in the volume of operational waste produced compared to feedback from the French and German units. It states that the estimated volume of solid waste was determined by combining the best quartile for each type of waste (and not per site). Hence, TQ asks for justification that the estimates are realistic for the UK EPR.	radioactive waste estimates is realistic since no quantitative information provided on waste minimisation initiatives etc. This TQ links with a TQ raised by HSE (TQ-EPR-124). After a presentation by EDF in September 2009 on their processes for recording and analysing information on radioactive wastes at its sites, three additional TQs were raised (TQ-EPR-468, TQ-EPR-469 and TQ-EPR-470).
TQ-EPR-221: Storage of EPR Low Level Waste	This TQ asks for further details on the short term buffer storage of LLW in the waste treatment building, for example, the capacity of the store.	In principle it provides assurance. We visited waste management facilities in 2010 to inform our assessments.
TQ-EPR-222: EPR Intermediate Level Waste	This TQ asks for evidence that the following waste streams are disposable. • Rod cluster control assemblies (RCCAs) • Redundant irradiated control rods • Neutron source assembly • Poison rod assemblies	Response states that it is expected that operational and decommissioning wastes such as RCCAs, Stationary Core Component Assemblies (SCCAs), and core instrumentation would be accepted in a GDF.
TQ-EPR-172: EPR ILW Decay to LLW	This TQ asks for information on the management of ILW that may decay to LLW during storage.	Information provided but some further details required at site-specific permitting, for example, confirmation that LLWR would accept wastes that have been decay stored.
TQ-EPR-409: Update on EPR Environment Design Review Recommendations	The information provided in November 2008, referred to some recommendations made in 2004 to minimise wastes and discharges. Hence, this TQ asks for an update on these.	Update on recommendations given.

RI/RO/TQ number and title	Reason for raising	Comments on response
TQ-EPR-468: QA Arrangements of Solid Waste Data	In response to TQ-EPR-124, EDF and AREVA provided a number of averaged inventories for different waste types. This did not provide enough detail for our assessment. Hence, this TQ asks for a list of the categories of physical nature that are used to describe waste. In addition, this TQ asks for details of any QA procedures and audits (both internally and external bodies) to indicate the level of confidence there is in the data.	Information provided.
TQ-EPR-469: Solid Radioactive Waste Date	To provide confidence that the estimates in the PCER and in response to TQ-EPR-124 are realistic for the UK EPR, further information was requested by this TQ.	Information provided.
TQ-EPR-470: Large, Solid Radioactive Waste Items	No information received in August 2007 submission and November 2008 information. Hence this TQ asks for demonstration that large one-off items, such as reactor pressure vessel heads and steam generators that could need replacing during operation can be stored, conditioned for disposal and are disposable.	Basic information provided.
TQ-EPR-960: Management of Radioactive Oils and Sludges	This TQ asks for information on the management of radioactive oils and sludges.	Information provided. In March 2011, this was incorporated into a supporting document (ECUK110016, EPR - Radioactive Waste Conditioning, Revision A).
TQ-EPR-961: Filter Encapsulation Facility	This TQ asks for information on the filter encapsulation facility.	Information provided. In March 2011, this was incorporated into a supporting document (ECUK110016, EPR - Radioactive Waste Conditioning, Revision A).
TQ-EPR-962: Operation of the Mercure Machine	EDF and AREVA propose to encapsulate waste using a Mercure machine. This TQ asks for information on this operation.	Information provided. In March 2011, this was incorporated into a supporting document (ECUK110016, EPR - Radioactive Waste Conditioning, Revision A).

RI/RO/TQ number and title	Reason for raising	Comments on response
TQ-EPR-963: Waste Treatment Building	This TQ asks for information on the waste treatment building, such as the management and disposal of; activated core components, dry active waste and resin wastes, and processing options other than the Mercure machine.	Information provided. In March 2011, this was incorporated into a supporting document (ECUK110016, EPR - Radioactive Waste Conditioning, Revision A).

3.2 Assessment objectives

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

a) Have all the sources of LLW and ILW been identified?

b) How will LLW and ILW be treated and conditioned?

c) Have all the disposal routes of LLW and ILW been identified?

d) Have the arisings of LLW and ILW been quantified?

e) Has BAT been applied to minimise the arisings of LLW and ILW?

3.3 EDF and AREVA documentation

32 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-0003-030	PCER – Chapter 3 – Aspects having a bearing on the environment during operation phase	03
UKEPR-0003-050	PCER – Chapter 5 – Design principles in relation to the decommissioning	04
UKEPR-0003-062	PCER – Sub-chapter 6.2 – Details of the effluent management process	04
UKEPR-0003-063	PCER – Sub-chapter 6.3 – Outputs for the Operating Installation	04
UKEPR-0003-064	PCER – Sub-chapter 6.4 - Effluent and waste treatment systems design architecture	04
UKEPR-0003-065	PCER – Sub-chapter 6.5 – Interim storage facilities and disposability for UK EPR	03
UKEPR-0003-080	PCER – Chapter 8 – Best Available Techniques	02
UKEPR-0011-001	GDA UK EPR-BAT Demonstration	04

Document reference	Title	Version number
NXA/10488242	GDA: Summary of Disposability Assessment for Wastes and Spent Fuel arising from Operation of the UK EPR	Sept 09
ELI0800226 A BPE	Dry Interim Storage facility for ILW	A
ELIDC0801302 A BPE	EPR UK – Decommissioning waste inventory	A
UKEPR-0010-001	GDA UK EPR – Integrated Waste Strategy Document	02
ELI0800226	Longer Term ILW ISF	A
NESH-G/2008/en/0123	Solid Radioactive Waste Strategy Report (SRWSR)	A
UKEPR-0008-001	Longer Term ILW Interim Storage Facility	01
REG EPR00182N (Appendix)	Critique of the NDA RWMD Disposability Assessment	25/09/09
TQ-EPR-124	Changes to waste characteristics over the life of the EPR	17/06/09
TQ-EPR-159	Solid Radioactive Waste Estimates	17/06/09
TQ-EPR-469	Solid Radioactive Waste Data	05/00/09
TQ-EPR-341	Disposability of EPR Waste Oils	16/11/09
TQ-EPR-222	EPR Intermediate Level Waste	27/11/09
UKEPR-0012-001	Mapping Document for Radioactive Waste Management Case	02
EPR70238R	RO-UKEPR-48 A.2 – Consolidation of the plan for disposability of waste and spent fuel	14/01/11
ECUK110016	EPR - Radioactive Waste Conditioning	A
EPR00918N	Clarification on the Incineration of ILW Evaporator Concentrates	29/07/11

33 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;

c) IWS = GDA UK EPR Integrated Waste Strategy Document;

d) SRWSR = UK EPR Solid Radioactive Waste Strategy Report.

3.4 Creation of solid waste

34 EDF and AREVA identify and quantify the solid radioactive waste that will arise during the operational phase (PCERsc3.3). They state that solid radioactive waste resulting from normal operation (including maintenance) arises either in the nuclear

island or in the waste treatment building (ETB). They say that the UK EPR will produce three types of solid radioactive waste (PCERsc6.2):

a) waste known as 'process' waste, associated with generating power. This results from treating fluids, in order:

   i) to limit the contamination and reduce its activity, so that workers are not exposed to radiation;

   ii) to reduce the activity of discharged effluent, whether aqueous or gaseous.

   The process waste from treating gaseous effluent is made up of mainly filters and iodine traps. From aqueous waste treatment, the process waste consists of filters, concentrates and ion-exchange resins.

b) dry active waste from maintenance work (mending faults, repairs, replacement of radioactive equipment, etc.). It comprises mainly of compactable materials, such as vinyl, gloves, adhesive tape, papers, trunking for exhaust fans, etc.

c) other waste, generally from so called sundry incidents (for example, contaminated oils).

35 Additionally, during the operation of the UK EPR, some core components used to control or measure neutron activity may need to be replaced during outages. These include neutron absorber rods and rod cluster control assemblies.

36 In the PCER and supporting documentation, the types of solid radioactive waste are described as shown in the table below:

	Types of waste
Process waste	Ion-exchange resins from the nuclear island
	Low activity steam generator blow down system (SGBS) ion-exchange resins (without regeneration)
	Wet sludges (sumps, tanks)
	Water filters from effluent treatment
	Evaporator concentrates
	Air and water filters
Operational waste	Pre-compacted and non compactable dry active waste (DAW)
	Oils (and solvents)
	Scraps
	Other operational waste

37 EDF and AREVA state that the volume of solid radioactive waste depends on the balance between environmental discharges and packaged waste generation in managing the installation and may therefore change according to the various effluent treatment methods. PCERsc3.3 Table 2 and PCERsc6.3 Table 1 provide, by volume, the annual estimated production of raw waste (before conditioning) for each type of waste for one UK EPR unit. PCERsc6.3 Table 5 gives the distribution of LLW and ILW in terms of volume of packages to be disposed of or stored per year. This shows that the volume of conditioned LLW to be disposed of per year is 24.5m^3, which, assuming the UK EPR design is for a single, pressurised water reactor (PWR) capable of generating in total 1735 MWe of electricity, is equivalent to 14.1m^3 per 1000 MWe plant-year of operation. This table also shows that the volume of conditioned ILW produced per year is 46.2 m^3, which is equivalent to 26.6m^3 per 1000 MWe plant-year of operation.

38 Further information is given in PCERsc6.3. This includes the characteristics of the reference case packaged wastes. Additionally, waste stream datasheets for ion exchange resins, spent filters, dry active waste, tank sludges, evaporator concentrates, low activity resins, air and water filters, oils and metal maintenance waste are given in EDF and AREVA's solid radioactive waste strategy report (SRWSR). These list data on waste origin, waste physical description, nature of radioactive material, annual arising, total arising, waste classification at time of generation, main radionuclides and hazardous substances.

39 EDF and AREVA have estimated the volume of solid radioactive decommissioning waste to be expected after a designed service life of 60 years. An estimated volume of conditioned LLW and very low level waste (VLLW) from decommissioning is around 25,000m^3 (PCERsc5.2s4.4). The waste is from the following sources:

a) primary circuit;

b) nuclear steam supply system equipment;

c) balance of nuclear island (BNI) equipment;

d) concrete due to clean up of BNI.

40 Estimated volumes of ILW from decommissioning are given in PCER chapter 5 and the SRWSR. Contaminated ILW, which consists of ion-exchange resins used during the full decontamination of the primary circuit, amounts to around 30 to 40 m^3. Activated ILW consisting of metallic and concrete waste from the dismantling of the activated components near the reactor core amount to approximately 450 te of raw solid metallic waste and 180 te of concrete. An estimated volume of conditioned ILW from decommissioning is around 1400m^3 (PCERsc5.2s4.4). The ILW waste is from the following sources:

a) primary circuit;

b) decontamination.

41 The estimates for operational waste in EDF and AREVA's submission for the volumes of operational LLW and ILW appear to be reasonable for the UK EPR. These estimates were derived by EDF and AREVA using 15 years worth of waste arisings data from across the whole French fleet. The estimates used data from the EDF tracking system which records the characteristics of every solid waste package produced on the 19 sites in France. (PCERsc6.3s3.1)

42 The Health Protection Agency (HPA) (GDA88[2]) provided the following response to our consultation: '*The consultation document should make it clear in its conclusions that AREVA and EDF's 'reference case', Flamanville 3, is still under construction and will not be operational for at least 2 years and therefore cannot provide evidence of actual waste arisings*.' As stated above, the estimates for operational waste were derived by EDF and AREVA using 15 years worth of waste arisings data from across the whole French fleet. We consider these estimates to be reasonable.

43 Additionally, the HPA (GDA88) commented that the reference on the review of waste arisings at comparable reactors (Isukul, 2009) is not available in the public domain, and therefore it is difficult to compare EDF and AREVA's estimates with

[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.

independently collated data. We can confirm that this reference is available through the Imperial College London library service.

44 The Committee on Medical Aspects of Radiation in the Environment (COMARE) (GDA129) commented that more emphasis should be placed on re-use, recycling and decontamination of waste on reaching authorisation limits, particularly for solid waste. We have not set any limits on solid radioactive waste in GDA, and we no longer set specific limits in permitting, relying on the principle that waste should be minimised at source. We agree that EDF and AREVA have only provided basic evidence of how they will minimise the quantities of LLW and ILW needing disposal. Hence, we require evidence during the detailed design phase that the proposed specific techniques for preventing and, where that is not possible, minimising the creation of LLW and ILW are BAT (UK EPR-AF11). We also require evidence during the detailed design phase that the proposed specific techniques for treating and conditioning of LLW and ILW before disposal are BAT (UK EPR-AF12).

3.5 Management and disposal of low level waste

45 In this section we cover our assessment of the management and disposal of LLW. LLW is defined in the UK as 'solid radioactive waste having a radioactive content not exceeding 4 GBq per tonne (GBqte^{-1}) of alpha or 12 GBqte^{-1} of beta / gamma activity', but we also consider here some liquid waste such as contaminated oils. These types of low level waste are usually suitable for disposal at the low level waste repository (LLWR) near Drigg, disposal by on or off-site incineration, or transfer off-site for recovery (for example, of metals).

46 Having minimised the overall production of radioactive waste, the application of BAT to minimise the activity in gaseous and aqueous discharges tends to transfer activity to low (and intermediate – see below) level solid waste. This is in line with the principle of preferred use of 'concentrate and contain' over 'dilute and disperse' (DECC, 2009a). There is little opportunity to reduce the activity of this waste, except by decay storage when the waste contains radionuclides with short half-lives. However, the volume of LLW requiring final disposal can be reduced by using techniques such as waste sorting and segregation, compaction, incineration, removal of surface contamination, re-use and recycling.

47 We summarise below the information presented in EDF and AREVA's submission on the management and disposal of LLW. We assessed all this information and used the GDA process of ROs and TQs to query and expand information where necessary. The conclusions of our assessment are provided at the end of this sub-section.

48 EDF and AREVA state in PCERsc6.2 that solid radioactive waste is segregated at source in each area as it arises, both in terms of activity and its chemical and physical characteristics (for example, combustible, compactable and non-combustible/non-compactable). Activity assessment is determined by measuring with handheld monitors and applying a nuclide fingerprint applicable for the source.

49 For the reference case, the treatment of operational LLW and ILW will be carried out by two solid radioactive waste treatment systems; the TES unit system located in the EPR nuclear auxiliary building (NAB) and the 8TES system located in the UK EPR waste treatment building (ETB). The 8TES system will comprise of effluent storage facilities for the resins and evaporator concentrates and conditioning facilities for the raw solid radioactive waste from the nuclear island and the ETB that results from normal operation. The TES unit system will handle the filter replacement and the transfer of resins from the NAB to the ETB. A filter handling machine will remove the used filters and place them in a concrete enclosure. Spent resins will be pumped to the 8TES storage tanks of the ETB by the 8TES system. EDF and AREVA propose that resins, filter contents, and other ILW will be encapsulated in concrete containers. There will be an installation in the ETB for

compacting low-activity operational waste. All conditioned waste will then be kept on site for interim storage before being sent off-site to a final disposal location or to a treatment plant for additional processing (for example, incineration, smelting etc). The treatments, conditioning and packaging of operational solid radioactive waste is presented in PCERsc6.3 Table 3 and detailed in PCERsc6.4. EDF and AREVA provide further information on other potential waste management arrangements in the ETB in the SRWSR to accommodate different operators.

50 In response to additional queries raised by ONR as part of its Step 4 assessment on conditioning of waste produced by the UK EPR, EDF and AREVA provided further information in December 2010. This included more information on the management of radioactive oils and sludges, and the ETB. This information is in the radioactive waste conditioning report (see 'EDF and AREVA documentation' section).

51 The following packaging will be used for LLW:

a) metallic drum 200 litres: These drums will mainly be used for the packaging of LLW to be shipped directly to the LLWR;

b) plastic drum 200 litres: These drums have been developed specifically for the incineration process and they are directly introduced to the furnace;

c) metallic boxes 1 m^3: These boxes will be used to collect and ship metallic waste and cut scraps for melting.

52 The storage capacity of the reference ETB is enough to ensure buffer storage of LLW for more than one year of operating, including maintenance operations, even in the case that two UK EPR units share the ETB. (PCERsc6.4s4.2.4.1.5).

53 EDF and AREVA state in PCERsc6.5 and in the SRWSR that during the timescale for disposal of ILW to a disposal facility, it is possible that some waste may decay below the ILW threshold limits. Although initially stored as ILW, these waste streams can be re-categorised, removed from the interim storage facility and shipped as LLW. The Health Protection Agency (GDA88) responded to our consultation saying that is not clear if as a result of this reclassification, or for other reasons, repackaging is likely to be required and what provisions have been made if this is the case. EDF and AREVA do not provide details of this in their submission. This is a matter that we will assess at the site-specific permitting stage.

54 Disposability of operational LLW is discussed in PCERsc6.5 of the PCER. EDF and AREVA will dispose of LLW promptly after it has been generated to the low level waste repository (LLWR). EDF and AREVA have completed LLWR form D1s (Request for agreement in principle to dispose of radioactive waste at the low level waste repository) for each of the UK EPR LLW streams (except waste oils). These forms describe the nature of the process producing the waste, the type of radioactive waste generated and the physical and chemical form of the waste and its radiological characteristics.

55 Although D1 forms have been completed for all UK EPR operational LLW (except waste oils), EDF and AREVA have identified waste streams that are likely to be suitable for incineration and smelting to minimise the waste sent to the LLWR. We note that we would need a BAT assessment to consider other options. We have an assessment finding on this (UK EPR-AF12).

56 EDF and AREVA have provided us with signed form D1s from the LLWR, giving agreement in principle for the treatment / disposal of the following LLW:

a) ion exchange resin;

b) ion exchange beads;

c) spent filter cartridges;

d) air filters and water filters;

e) maintenance and operational very low level waste;

f) stainless steel waste;

g) maintenance and operational low level waste;

h) sludges;

i) concentrates.

57 The LLWR recognises that EDF and AREVA's form D1 applications represent assumed waste disposals at some point in the future and, as such, it cannot guarantee future capacity today. However, the LLWR has assessed EDF and AREVA's application against their current arrangements and can give agreement in principle on the basis that this waste would be suitable for treatment / disposal against their current arrangements.

58 EDF and AREVA state that contaminated waste oils and oily, solvent or greasy rags produced by maintenance will be incinerated. They provide evidence that this waste will meet the conditions for acceptance at the Centraco facility in France. They also provide confidence that these types of waste would be accepted at the Tradebe incinerator in the UK. (PCERsc6.2s3.4.1.2)

59 Smelting is also considered for LLW metals as described in PCERsc6.3. However, EDF and AREVA have not carried out a review of this waste stream against the conditions of acceptance of a smelting facility to show that they can be met. This is therefore the subject of assessment finding UK EPR-AF13.

60 Incineration is also considered for SGBS ion-exchange resins (without regeneration), evaporator concentrates, pre-compacted operational waste and operational waste as mentioned in PCERsc6.3. However, EDF and AREVA have not carried out a review of these waste streams against the conditions of acceptance of an incineration facility to show that they can be met. Therefore, this is the subject of assessment finding UK EPR-AF14.

61 EDF and AREVA have considered the treatment and disposal of large, one-off solid radioactive waste items that could need replacing during the operation of the UK EPR. They consider steam generators and reactor pressure vessel heads. EDF and AREVA state that these items will be LLW and that one method of treatment and disposal will be to cut them into pieces, place pieces in containers and send containers for disposal at the LLWR. (PCERsc6.3s3.2.6)

62 EDF and AREVA expect decommissioning waste will produce similar waste types as the operational phase and, therefore, assume it will be compliant with the LLWR acceptance criteria. The SRWSR assumes that the LLW produced during the dismantling of a reactor is conditioned by packing in half height ISO (HHISO) containers. EDF and AREVA provided a document detailing their decommissioning waste inventory evaluation (ELIDC0801302A).

63 EDF and AREVA state in PCERsc6.3 that they currently envisage reducing the sources of solid waste volume compared with the existing plants' feedback as follows:

a) designation at the design stage of clean-waste zoning, enabling sorting of waste at source and segregating of conventional waste from non-contaminating work in the restricted area;

b) better control of source term through carefully selecting materials in contact with the primary coolant, which then leads to reduced production of corrosion products (a reduction in cobalt 60 activity in particular);

c) optimisation of the chemical treatment of primary coolant;

d) a greater surface area on the chemical and volume control system (CVCS) purification filters than on the 1300 MWe and N4 units (predecessor to the UK EPR), through using multi-cartridge baskets and not single cartridge.

We consider this to be good practice.

64 EDF and AREVA state that it should be noted that the volume of solid waste depends on the balance between environmental discharges and packaged waste generation in managing the installation, and may, therefore, change according to the various effluent treatment methods.

65 EDF and AREVA state in PCERsc6.5 that in order to minimise the inventory of waste consigned to LLWR, where the characteristics of LLW streams or packages are such that they could be treated as VLLW, LLWR have confirmed that they will offer services to dispose of such waste.

66 EDF and AREVA state in PCERsc8.2 that an 'EPR environment' design review took place in October 2004. One recommendation from this was to reduce the volume of solid waste, in particular by optimising the room zoning and a detailed analysis of the operating procedures and waste inventory of the existing units. They claim that they will reduce the volume of solid waste by ensuring waste is segregated as it is generated, mainly during maintenance operations in the nuclear buildings. (PCERsc8.2s2.3) We accept this review finding. The Committee on Medical Aspects of Radiation in the Environment (GDA129) commented that they commend this approach aimed at minimising solid waste production.

67 In PCERsc8.2, EDF and AREVA describe how they consider that BAT has been applied to each significant waste stream. EDF and AREVA state in their BAT demonstration report (EPRB) that BAT is being applied in the design of the UK EPR to minimise radioactive waste at source and to minimise the impacts of the disposal of waste into the environment. Having reviewed this information, we accept that the UK EPR uses BAT to minimise the arisings of LLW subject to assessment finding UK EPR-AF11.

68 The SRWSR states that the UK EPR design will enable decommissioning to be performed to minimise radiation doses to workers and minimise the amount of radioactive waste generated. 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.

69 EDF and AREVA state that improvements and provision are included in the UK EPR design based on feedback experience, in order to avoid replacing during the UK EPR's 60 years of operation large one-off items such as reactor pressure vessel heads and steam generators. They also state that good chemistry management during operation should prevent the build up of crud and activity due to contamination in the steam generators over the operating life. (PCERsc6.3s3.2.6)

70 Ingleby Barwick Town Council (GDA38) provided the following response to our consultation: '*This needs much more detail to give the public reassurance and to prevent misinformation from the anti-nuclear lobby. Need to reduce Cobalt 60 as it is a corrosive product. Need strict supervision of waste. Keep waste separate to reduce contamination of LLW*.'

71 We agree that waste should be minimised. We require evidence during the detailed design phase that the proposed specific techniques for preventing and, where that is not possible, minimising the creation of LLW and ILW are BAT. We also require evidence during the detailed design phase that the proposed specific techniques for treating and conditioning of LLW and ILW before disposal are BAT. These are assessment findings in our conclusions on solid radioactive waste (UK EPR-AF11 and UK EPR-AF12). Subject to these assessment findings, we are satisfied that the UK EPR uses BAT to minimise the arisings of LLW and ILW and uses BAT to treat and condition LLW and ILW prior to disposal.

72 Maldon Town Council (GDA51) provided the following response: '*Solid radioactive waste treatment as proposed not up to spec of Magnox South e.g., Bradwell. We see no need for local incineration, transport by rail a better option for eventual disposal. UK EPR we note your sceptical comments. Also that on site smelting has been considered, as has incineration, but not carried out a review of waste streams. Just implied that other plants around the world are worse. Only basic evidence provided*'.

73 We do not expect the information on solid radioactive waste treatment to have the same level of detail as that of an existing plant or one that is undergoing decommissioning. We agree that EDF and AREVA have only provided basic evidence of how they will minimise the quantities of LLW and ILW needing disposal. Hence, we require evidence during the detailed design phase that the proposed specific techniques for preventing and, where that is not possible, minimising the creation of LLW and ILW are BAT (UK EPR-AF11). We also require evidence during the detailed design phase that the proposed specific techniques for treating and conditioning of LLW and ILW before disposal are BAT (UK EPR-AF12). We also have assessment findings that if smelting or incineration of LLW is pursued, the future operator shall demonstrate that the conditions of acceptance of the selected smelting / incineration facility can be met (UK EPR-AF13 and UK EPR-14).

74 Several respondents, including the Nuclear Legacy Advisory Forum (NuLEAF) (GDA80), Somerset County Council (GDA161), Cumbria County Council (GDA166), West Somerset Council and Sedgemoor District Council (GDA154), and Suffolk County Council (GDA72) thought that we were being overly optimistic in our conclusions on LLW because of the amount of space available for disposal at the LLWR, the time it would take to site any replacement LLW disposal facilities and the extent that landfills will become available for the disposal of VLLW. Additionally, at our stakeholder seminar, the following four questions / comments were raised: '*The adequacy and responsibility for the existing low level waste storage (off site)? What is the NDA's responsibility? What is the capacity and suitability of storage space for the new build? Concerns due to lack of planned waste storage facility.*' This is outside the scope of GDA because under the Energy Act 2004, the NDA has the responsibility for developing a UK-wide strategy for managing the UK nuclear industry's LLW.

75 Suffolk Coastal District Council (GDA165) responded to our consultation stating that it supports the response from NuLeaf (GDA80), dated 4 October 2010, given that the Council is a member of NuLeaf and has in the past expressed concerns about the arrangements for nuclear waste storage / disposal. We have addressed the response from NuLeaf in several chapters within our decision document.

76 NNB Genco (GDA106) provided the following response to our consultation: '*We welcome the Environment Agency's conclusions on solid radioactive waste, that all waste streams have been identified and that proven and recognised treatment and*

conditioning techniques will be used. We agree that the design is not expected to produce Low Level Waste (LLW) for which there is no foreseeable disposal route. We recognise that prospective operators, including NNB GenCo, will need to demonstrate that site specific strategies for waste management represent BAT. NNB GenCo will work to implement an Integrated Waste Strategy, informed by the Waste Hierarchy, which optimises treatment methods and disposal routes in step with development of the UK LLW strategy.'

77 Horizon Nuclear Power (GDA127) provided the following response with respect to the issues raised in our consultation document on LLW:

a) **'***Meeting the conditions of acceptance for smelting of LLW during site-specific permitting: Horizon is rather surprised that this issue was raised specifically. It is clear that if we wish to pursue smelting of LLW as part of a recycle, reuse and waste minimisation strategy, then we would need to identify an appropriate service provider and discuss with them whether our waste could be handled by their facility.'*

b) *'Meeting the conditions of acceptance for incineration of waste during site-specific permitting: Horizon is rather surprised that this issue was raised specifically. It is clear that if we wish to pursue incineration of waste as a waste minimisation strategy, then we would need to identify an appropriate service provider and discuss with them whether our waste could be handled by their facility.'*

c) *'Evidence during site-specific permitting that specific arrangements for minimising the disposals of LLW and ILW are BAT: Horizon is aware that during site-specific permitting it will need to present information to demonstrate BAT. Minimising the disposals of LLW and ILW is intimately linked with how the reactor is operated, what discharge abatement technology is deployed and what conditioning and packaging technologies are used. Minimising the quantities of waste for disposal is not something that can be targeted in isolation but will instead be a balance between a number of competing issues such as operator doses and environmental discharges*.'

78 We have raised the smelting and incineration of waste as assessment findings because the estimates for the volumes of LLW in EDF and AREVA's submission are based on the assumption that some will be smelted or incinerated. We understand that if this is not the case then the volumes will be higher than that estimated. We note that EDF and AREVA have provided us with approved form D1s from the LLWR, giving agreement in principle for the treatment / disposal of the waste in this category. We agree that operators should use BAT to achieve a high degree of protection of the environment, taken as a whole and to meet the principle of optimisation.

79 West Somerset Council and Sedgemoor District Council (GDA154) made the following point in response to our consultation: 'The techniques and processes described generally appear satisfactory; however several of these, for example metal smelting and incineration, rely on the establishment and development of suitable supply chains to ensure that they can play an effective role in waste minimisation. Where these do not exist, the burden of waste management will fall entirely on disposal to GDF and LLWR.' We note this comment but this is outside the scope of GDA. We also note that incineration and metal recycling facilities are now available.

80 Studsvik UK Ltd (GDA131) provided the following response: *'BAT needs to be applied to the waste treatment as well. It is not clear how BAT or the Waste Management Hierarchy has been considered for all solid radioactive wastes. Treatment of metallic waste has been considered, but no facilities have been investigated or if the potential waste will fit their waste acceptance criteria (WACs). Incineration of LLW has been checked against the WACs for one facility, Centraco,*

partly owned by EDF and one VLLW facility in the UK'. We agree that EDF and AREVA have only provided basic evidence of how they will minimise the quantities of LLW and ILW needing disposal. Our assessment findings UK EPR-AF11 and UK EPR-AF12 address this. Assessment findings UK EPR-AF13 and UK EPR-AF14 address the WAC comment.

81 Several respondents, including; individual respondents (GDA25, GDA84), the Nuclear Technology Subject Group of the Institution of Chemical Engineers (GDA67), Springfields Site Stakeholder Group (GDA96), Horizon Nuclear Power (GDA127) and the Institution of Mechanical Engineers (GDA145) said that they were satisfied with our conclusions on solid radioactive waste.

82 **We conclude that:**

a) **EDF and AREVA have identified all LLW waste streams that a UK EPR will typically produce.**

b) **The UK EPR uses BAT to minimise the arisings of LLW, subject to assessment finding UK EPR-AF11.**

c) **The UK EPR uses BAT to treat and condition LLW prior to disposal, subject to assessment finding UK EPR-AF12.**

d) **The UK EPR is not expected to produce LLW for which there is no foreseeable disposal route. EDF and AREVA have demonstrated that the waste streams would meet the criteria for disposal in a LLW facility.**

83 **EDF and AREVA have provided valid estimates for the annual arisings (during operations and decommissioning) of LLW. These arisings (during operations) are consistent with those of comparable reactors around the world (Isukul, 2009). The arisings of LLW are below the European Utility Requirement (European Utility Requirements for LWR Nuclear Power Plants Rev C Apr 2001 (Volume 2 chapter 2, section 5.2)) objective of less than 50 m^3 per 1000 MWe plant-year of operation.**

3.6 Management and disposal of intermediate level waste

84 In this section we cover our assessment of the management of ILW. ILW is waste with activity levels exceeding the upper boundaries for LLW, but which does not require heat generation to be accounted for in the design of disposal or storage facilities. There are currently no final disposal facilities for ILW in the UK. However, the Government has stated (BERR, 2008a) that it is satisfied that:

a) a geological disposal facility would provide a possible and desirable mechanism for disposing of higher level waste (both from a new nuclear programme and existing legacy waste);

b) there are feasible and long-term mechanisms through the Managing Radioactive Waste Safely (MRWS) (Defra et al 2008) programme for identifying a suitable site and for constructing a geological disposal facility.

85 Although a permit for final disposal may not be required for a considerable time, we expect EDF and AREVA to show now whether the waste:

a) is likely to be suitable for disposal in a geological repository;

b) will be appropriately managed in the interim, so as not to prejudice its ultimate disposal.

86 We summarise below the information presented in EDF and AREVA's submission on the management and disposal of ILW. We assessed all this information and used the GDA process of ROs and TQs to query and expand information where necessary. The conclusions of our assessment are provided at the end of this sub-section.

87 EDF and AREVA state in PCERsc6.2 that solid radioactive waste is segregated at source in each area as it arises, both in terms of activity and its chemical and physical characteristics (such as combustible, compactable and non-combustible / non-compactable).

88 For the reference case, the treatment of operational LLW and ILW will be carried out by two solid radioactive waste treatment systems; the TES unit system located in the EPR nuclear auxiliary building (NAB) and the 8TES system located in the UK EPR waste treatment building (ETB). The 8TES system will comprise of effluent storage facilities for the resins and evaporator concentrates and conditioning facilities for the raw solid radioactive waste from the nuclear island and the ETB that results from normal operation. The TES unit system will handle the filter replacement and the transfer of resins from the NAB to the ETB. A filter handling machine will remove the used filters and place them in a concrete enclosure. Spent resins will be pumped to the 8TES storage tanks of the ETB by the 8TES system. EDF and AREVA propose that resins, filter contents, and other ILW will be encapsulated in concrete containers. There will be an installation in the ETB for compacting low-activity operational waste. All conditioned waste will then be kept on site for interim storage before being sent off-site to a final storage location or to a treatment plant for additional processing (for example, incineration, smelting etc). The treatments, conditioning and packaging of operational solid radioactive waste is presented in PCERsc6.3 Table 3 and detailed in PCERsc6.4. EDF and AREVA provide further information on other potential waste management arrangements in the ETB in the SRWSR to accommodate different operators.

89 In response to additional queries raised by ONR as part of its Step 4 assessment on conditioning of waste produced by the UK EPR, EDF and AREVA provided further information in December 2010. This included more detailed information on conditioning spent resins, using a mobile machine process, and complementary information on the operation of the filter changing machine and encapsulation of filters and dry active waste (greater than 2 mSv h^{-1}), and the ETB. This information is in the radioactive waste conditioning report (see 'EDF and AREVA documentation' section).

90 The characteristics of decommissioning conditioned waste are given in PCER chapter 5 and in the SRWSRs.

91 C1 and C4 concrete containers (these containers are 15 cm thick and have the physical capability to last and confine radioactivity for more than 300 years) are used for packaging ILW in the reference case (PCERsc6.3). Other options for packaging ILW in stainless steel and cast iron containers for disposal are mentioned in the SRWSRs7.4.2.

92 ILW will be stored on the UK EPR sites in dedicated building(s) until a final disposal site for ILW is opened in the UK. The radioactive decay during interim storage of ILW due to its composition of short-lived radionuclides can reduce the final quantities of ILW to be disposed of. Some of this waste could be reclassified as LLW. The ILW interim storage facility will be designed to be in operation for up to 100 years after first fuel loading.

93 Design information on possible option(s) regarding interim storage facilities for ILW is provided in PCERsc6.5 and in the SRWSR. Designs for two ILW storage options are described. These can be adapted to store additional ILW that is generated during decommissioning.

94 Disposability of operational ILW is discussed in PCERsc6.5. In order to assess the disposability of ILW, EDF and AREVA provided the Nuclear Decommissioning Authority (NDA) with a datasheet for each of the UK EPR waste streams. Each datasheet included information on the nature of the waste stream, rate of arising, proposed matrix, package type, physical and chemical composition and

radionuclide inventory, package heat output and external dose rate. EDF and AREVA have provided us with datasheets for the following operational waste types:

a) spent resins (ILW) raw waste;

b) spent cartridge filters (LLW + ILW);

c) operational waste (LLW + ILW);

d) wet sludges (LLW + ILW);

e) evaporator concentrates (LLW + ILW).

95 EDF and AREVA have provided us with datasheets for the following decommissioning waste types:

a) lower internals from EPR pressure vessel: heavy reflector, lower support plate, lower heavy reflector support;

b) upper internals: upper support columns and upper core plate. Lower internals: core barrel, flow distribution device;

c) reactor vessel: parts from the reactor vessel near the core.

96 EDF and AREVA have obtained and provided to us a view from the Radioactive Waste Management Directorate (RWMD) of the Nuclear Decommissioning Authority (NDA) (as the UK authoritative source) on the disposability of their proposed arisings of ILW. RWMD concluded that compared with legacy waste, no new issues arise that challenge the fundamental disposability of the waste expected to arise from operation of the UK EPR (see 'EDF and AREVA documentation' section). EDF and AREVA also provided the Regulators with their critique of the RWMD disposability assessment, which considered the impact of RWMD's disposability assessment on their plans for conditioning, storing and dispatching the waste to a repository.

97 Since our consultation, NDA has published a generic Disposal Systems Safety Case (gDSSC) for a future Geological Disposal Facility (GDF), based on its understanding of the scientific and engineering principles supporting geological disposal (RWMD, 2010). NDA has also provided a report regarding the impact of the gDSSC on its previous new build disposability assessments undertaken for RPs to support GDA submissions (RWMD, 2011). The report concludes:

a) '*The original 2009 GDA Disposability Assessments concluded that ILW and spent fuel from operation and decommissioning of an AP1000 or EPR raised no new disposability issues when compared against legacy wastes and existing spent fuel. These assessments have been reviewed in the light of recent developments to disposal concepts and generic safety assessment methodologies as applied in the generic DSSC.*

Overall, the changes in concept, assessment methodology and assumptions regarding parameter values have only minor impacts on the findings of the original GDA Disposability Assessments. The review therefore confirms that there are no new issues arising from the generic DSSC that would challenge the fundamental disposability of the wastes and spent fuel expected to arise from operation of the AP1000 and EPR. This conclusion is supported by the similarity of the wastes to those expected to arise from the existing PWR at Sizewell B, which are included in the generic DSSC Baseline Inventory and have been found to be acceptable.'

98 The Regulators requested further information on the volume and radionuclides / activity for waste, including rod cluster control assemblies (RCCAs); redundant irradiated control rods; neutron source assembly and poison rod assemblies, including evidence that they will be disposable. EDF and AREVA confirmed that they consider RCCAs and redundant irradiated control rods to be the same and would be ILW, and explained that there are no distinct poison rod assemblies since

burnable poison, gadolinium, is mixed with uranium dioxide in some fuel assembly rods with low uranium-235 enrichment. EDF and AREVA provided information on the volume and radionuclides / activity, and on interim storage proposals and packaging for disposal. EDF and AREVA state that it is expected that this waste would be accepted in a geological disposal facility. RWMD state that RCCAs were not included in the initial disposal inventory supplied by EDF and AREVA, although these items may have high specific activity, they will not be of large volume, and, therefore, are not expected to affect disposability of wastes from a UK EPR. They also state that these components could be managed as ILW or, given their dimensions, packaged as a complete unit with their associated fuel assembly. The RCCAs are longer than the spent fuel, but can be reduced in size by removing the end supports. Hence, RWMD said that in any future submission under the Letter of Compliance (LoC) process, the operator should provide further information on proposals for the management of RCCAs. This is covered by assessment finding UK EPR-AF10 (see below).

99 The Regulators requested EDF and AREVA to make a case for the disposability of spent fuel and ILW, which demonstrates the following:

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

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

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

100 EDF and AREVA provided information in February and March 2010. We note in particular that EDF and AREVA have consulted with RWMD specifically on the stages in the LoC process at which they would expect issues to be addressed. We recognise that, in most cases, these issues will need to be addressed by future operators of UK EPRs, rather than by EDF and AREVA, and we understand that EDF and AREVA have also discussed the timing of resolution of these issues with the potential UK EPR operator.

101 Since our consultation was published, EDF and AREVA have provided further information in January 2011 on their plan for disposability of ILW which includes the plan for long-term storage and the work being undertaken by RWMD (see 'EDF and AREVA documentation' section). The plan outlines the activities necessary to provide further confidence that ILW is disposable.

102 In general, we consider the plans proposed by EDF and AREVA, outlining how and when they and future licensees will address the outstanding disposability issues to be adequate at this stage. We will expect these plans to be periodically refined and updated in future to reflect developments. We will expect prospective licensees to make progress on demonstrating disposability at the earliest reasonable opportunities rather than waiting for dates specified in the plan.

103 We note that EDF and AREVA have produced a 'mapping document', intended to indicate where the information that will be needed for future radioactive waste management cases (RWMCs) will come from, and when. This document gives us some assurance at this stage that RWMCs can be compiled at relevant stages in the development of a UK EPR fleet, which is sufficient at this stage of the GDA process.

104 In January 2011, EDF and AREVA provided an updated 'mapping document', which incorporates comments from the Regulators and a review of all relevant documents that have been submitted as part of GDA since the original mapping document was submitted. The updated document gives us sufficient assurance for this stage of the GDA process that RWMCs can be compiled at relevant stages in the development of a UK EPR fleet.

105 We have assessed this further information on disposability from EDF and AREVA and their updated mapping document and have identified the following assessment finding: The future operator shall provide confidence that adequate RWMCs, supported by appropriate stage LoCs, can be developed for all ILW on the timescales identified in EDF and AREVA's plan for disposability of ILW. (UK EPR-AF10)

106 ONR has reviewed information on long-term storage of ILW in its Step 4 assessment. We have worked jointly with ONR throughout the GDA process in the area of solid radioactive waste assessment and our conclusions are consistent.

107 EDF and AREVA state in PCERsc6.3 that they currently envisage reducing the sources of solid waste volume compared to feedback experience as follows:

a) designation at the design stage of clean-waste zoning, enabling sorting of waste at source and segregating conventional waste from non-contaminating work in the restricted area;

b) better control of source term through carefully selecting materials in contact with the primary coolant, which then leads to reduced production of corrosion products (a reduction in cobalt-60 activity in particular);

c) optimisation of the chemical treatment of primary coolant;

d) a greater surface area on the CVCS purification filters than on the 1300 MWe and N4 units (predecessors to the UK EPR), through using multi-cartridge baskets and not single cartridge.

108 EDF and AREVA state that it should be noted that the volume of solid waste depends on the balance between environmental discharges and packaged waste generation in managing the installation and may, therefore, change according to the various effluent treatment methods.

109 EDF and AREVA state in PCERsc8.2 that an 'EPR environment' design review took place in October 2004. One recommendation from this was to reduce the volume of solid waste, in particular by optimising the room zoning and a detailed analysis of the operating procedures and waste inventory of the existing units. They claim that they will reduce the volume of solid waste by ensuring waste is segregated as it is generated, mainly during maintenance operations in the nuclear buildings (PCERsc8.2s2.3). We accept this review finding. The Committee on Medical Aspects of Radiation in the Environment (GDA129) commented that they commend this approach aimed at minimising solid waste production.

110 In PCERsc8.2, EDF and AREVA describe how they consider that BAT has been applied to each significant waste stream. EDF and AREVA claim in their BAT demonstration report (EPRB) that BAT is being applied in the design of the UK EPR to minimise radioactive waste at source and to minimise the impacts of the disposal of waste into the environment. Having reviewed this information, we accept that the UK EPR uses BAT to minimise the arisings of ILW subject to assessment finding UK EPR-AF11.

111 PCER chapter 5 and the SRWSR states that the UK EPR design will enable decommissioning to be performed whilst minimising radiation doses to workers and minimising radioactive waste generation. They discuss 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.

112 EDF and AREVA state that improvements and provision are included in the UK EPR design based on feedback experience, in order to avoid replacing during the UK EPR's 60 years of operation large one-off items such as reactor pressure vessel heads and steam generators. They also state that good chemistry management during operation should prevent the build up of crud and activity due to contamination inside the tubes, over the steam generators' operating life. (PCERsc6.3s3.2.6).

113 Comments on ILW received from the public involvement process relating to the UK EPR design by 4 January 2008 were addressed in our preliminary assessment report (Environment Agency, 2008a). One comment on this subject was received during our detailed assessment stage. The comment asked whether the UK EPR design adequately caters for the encapsulation, storage and disposal of ILW. EDF and AREVA responded with information that is available in their submission, that is that ILW is encapsulated in concrete containers and that final ILW packages will be placed in an interim storage facility before their disposal in the proposed GDF.

114 One of the questions raised at the stakeholder seminar was: '*Disposability of waste and spent fuel – not covered adequately in consultation / public domain. What are the options and timescales?'* Disposability of solid radioactive waste was discussed in chapter 11 of the consultation document and spent fuel in chapter 12, and subsequently in the equivalent chapters of our decision document. This included information on options and timescales but we note that additional information is available in our assessment reports. The assessment reports are published on our website. Additionally, since our consultation was published, as mentioned above, we received further information from EDF and AREVA on disposability in January 2011 (see 'EDF and AREVA documentation' section).

115 Another question raised at the stakeholder seminar, was what are the options for the storage of intermediate and high level waste, both on-site and off-site, and what are the most likely options and why. As stated above, design information on possible option(s) regarding interim storage facilities for ILW is provided in PCERsc6.5 and in the SRWSR. Designs for two ILW storage options are described. The option that will be chosen is dependent on the operator.

116 At the stakeholder seminar, the following comment was made: '*CoRWM recommended that new build waste be subjected to a separate process. This waste is of a different order, and should have its own safety case'*. It is the responsibility of the NDA to develop a safety case for any proposed geological disposal facility.

117 Blackwater Against New Nuclear Group (BANNG) (GDA112) provided the following response to our consultation: '*It is proposed to manage long-lived solid radioactive wastes (ILW) and spent fuel on site. There are two problems here. The first is that the methods of management are not specified in detail and may be subject to variation. It is assumed that wastes will eventually be disposed of in a geological repository and, in the meanwhile, will be appropriately managed. ILW will be immobilised and encapsulated and stored on site or possibly moved to another (regional or central) store until a repository becomes available. Beyond this the design details are vague and the regulators are clearly unsatisfied with the level of information provided. In the case of ILW they require 'more information on the potential for degradation of ILW over the longer term that might affect disposability*

and safe storage' (p.85). More information will be required on proposed storage facilities. In particular the risks to workers, the environment and to the population arising from encapsulation, waste transfer and transport needs to be assessed and there is precious little information on these matters. The regulators regard the management of these wastes as a key issue and will be looking in more detail at the plans in its Step 4 assessment. Indeed, it may be said that the information supplied in the consultation document is vague and far too flexible. Therefore in answer to Question 6, BANNG considers the response by the regulators to be complacent and inadequate. In our view the regulators should call for a much more detailed and robust explanation of proposed ILW storage together with details of the methods and facilities required and indicate that this should be supplied as part of the current assessment and not delayed until Step 4'.

118 Kent Against a Radioactive Environment (KARE) (GDA147) and Bradwell for Renewable Energy (GDA121) said that they fully endorse BANNG's response to the Generic Design Assessment consultation.

119 The Regulators received additional information from EDF and AREVA in January 2011 (see 'EDF and AREVA documentation' section) that we have assessed and this is discussed above. We note that ONR regulates nuclear safety, including the safe management, conditioning and storage of wastes on nuclear licensed sites, and DfT regulates the safe transport of radioactive material.

120 An individual respondent (GDA119) said that it is highly likely that a waste repository will never be built and the stores should be designed to fulfil all requirements on the assumption that high level waste and spent fuel will be on site permanently. Another individual respondent (GDA135) stated that the conclusions drawn rest on the assumption that geological disposal of ILW is technically achievable and that this is at best speculative and not supported by the available evidence. Communities Against Nuclear Expansion (GDA48) said that there is no proven safe way of disposing of nuclear waste and as a result have to store it for timescales beyond the human imagination, at least ten thousand and maybe up to two hundred thousand years. West Somerset Council and Sedgemoor District Council (GDA154) said that they are concerned with potential risks associated with the delay and delivery of the GDF programme, which runs the risk of continued need for on-site ILW and spent fuel stores until an ultimate disposal route is established.

121 Additionally, at our stakeholder seminar, concerns about the GDF and the fall back for the storage for the lifetime of waste if the GDF falls through were raised. Another individual respondent (GDA14) raised similar concerns on the AP1000 which is also applicable to the UK EPR: '*Westinghouse's radioactive waste and spent fuel strategy does all it can do within the boundaries and uncertainties of UK policy and waste facilities. This would, in the event that multiple new build reactors are commissioned and the GDF programme is unchanged or delayed, run the risk of several / many isolated waste and spent fuel stores on otherwise decommissioned reactor sites. Some form of centralised UK waste storage would probably be more optimal for many points of view - but there is time for such optimisation to be considered.*' Nuclear Waste Advisory Associates (NWAA) (GDA133) and the UK and Ireland Nuclear Free Local Authorities (NFLA) (GDA82), both provided the following point in the conclusions of their responses and the Nuclear Consultation Group (GDA149) quoted this from NFLA: '*At present it is quite apparent the nuclear industry would not be able to dispose of new build reactor wastes safely. It would be wholly irresponsible to wait until such wastes are created to confirm this. Unless and until the nuclear industry are able to demonstrate that new reactor wastes could be disposed of safely there should be no further steps taken towards the development of new reactors.*' They also quoted this from Blackwater Against New Nuclear Group: '*Regulators must suspend the GDA process until such time as there is adequate information provided on how the wastes arising from new build will be managed and there is in place a long-term*

management solution that is scientifically robust and socially acceptable.' A similar comment from our stakeholder seminar was: '*Concern with the whole waste management issue – GDA fails to consider adequately waste management – has no answers – relies on disposal / repository being available – not certain? The concept of a central store is new – what does this mean?*'

122 Government considered the issue as to whether ILW and spent fuel should be created by new reactors prior to the availability of a GDF when it consulted on energy policy. We note that DECC has published its response to the consultation on the Draft National Policy Statements (NPS) for Energy Infrastructure. With respect to radioactive waste management, DECC had asked the following question in its consultation: '*Do you agree with the Government's preliminary conclusion that effective arrangements will exist to manage and dispose of the waste that will be produced by new nuclear power stations in the UK?'* Having considered carefully the responses to this question, the Government has concluded that it is satisfied with the preliminary conclusion set out in the draft NPS. The Nuclear NPS confirms that the Government is satisfied that effective arrangements will exist to manage and dispose of the waste that will be produced by new nuclear power stations in the UK. We note that CoRWM have said that the Government must judge whether all the arrangements will exist by the time they are needed (CoRWM, 2010). We also note that the Government base case for new build is that a facility for long-term storage of high level waste and spent fuel will be available in time to receive the wastes from new reactor build. With respect to the comment on a central store, this is outside the scope of GDA.

123 Studsvik UK Ltd (GDA131) provided the following response: '*Incineration or grouting of ion-exchange resin can not be considered BAT. Technologies such as steam reforming will minimise the waste from the ion exchange resin with a factor 7 to 30 depending on resin type, loading and boron content.*' Additionally, Nuclear Waste Advisory Associates (GDA133) and the UK and Ireland Nuclear Free Local Authorities (GDA82), both provided the following point in their responses: *'EDF assume that certain ILW can be incinerated leaving no radioactive residue. The EA state that this assumption: "needs further explanation" – and that the incineration of ILW would be "novel". The EA should rule out incineration of these wastes at this stage, as it would clearly fail to meet the requirement 'Best Available Techniques'*. Stop Hinkley (GDA157) said that they are appalled that an operator may incinerate ILW just to reduce the volume of waste. RWMD said in its disposability assessment that : *'The EDF and AREVA submission assumed that, in the Reference Case, evaporator concentrates would be incinerated leaving no radioactive residue, which is the current practice in France.*' The assumption cited by RWMD that evaporator concentrates can be incinerated leaving no radioactive residue will need clarification in LoC submissions and in the RWMC if a future operator proposes such incineration. We require evidence during the detailed design phase that the proposed specific techniques for treating and conditioning of ILW before disposal are BAT (UK ERP-AF12). We have also identified the following assessment finding: If incineration of any intermediate level waste (ILW) is pursued, the future operator shall, demonstrate that the conditions of acceptance of the selected incineration facility can be met (UK EPR-AF15). We note that EDF and AREVA wrote to us in July 2011 (Letter: EPR00918N) stating that there is no intention to perform such incineration in the UK, and that the waste incinerated in France is LLW, not ILW..

124 Nuclear Waste Advisory Associates (NWAA, GDA133) and the UK and Ireland Nuclear Free Local Authorities (GDA82), both provided the following comment on radioactive carbon in ILW in their responses: '*Work by Nirex has indicated that carbon from a nuclear disposal facility could escape as radioactive methane gas and carbon dioxide. This would be able to quickly reach people at the surface. Nirex have calculated the resultant risk could be as high as 100 times the allowable limit as soon as the dump has been closed. There would be a relatively large*

inventory of radioactive carbon in decommissioning waste. The NDA's Radioactive Waste Management Division (RWMD) says this need not be a significant concern. The EA says these arguments are rather speculative at this stage and will need to be underpinned more convincingly. Yet EA recognise the NDA is unlikely to have more confidence in their risk estimates associated with radioactive carbon in repository-generated gases before a site for the GDF has been selected. So there will be a continuance along the road of new reactor construction before there is knowledge of whether or not waste containing radioactive carbon can be 'disposed' of safely.'

125 We agree that this matter needs to be resolved, but on the balance of the evidence to date we see no compelling reason to conclude that it cannot be resolved. The details of gas migration from the GDF – which will determine the impact – are expected to be very site-dependent and so can only really be addressed when a site has been identified.

126 The UK and Ireland Nuclear Free Local Authorities (GDA82) provided the following comment on waste in their response and the Nuclear Waste Advisory Associates (GDA133) and Greenpeace (GDA151) provided very similar ones: '*Information from the nuclear industry on the 'disposal' of waste from new reactors is available in several reports. However, at Section 3.3 of the EA assessment reports on the disposability of ILW and spent fuel, a number of unspecified issues are referred to that the EA has raised with the nuclear industry. Neither the issues – nor the industry response is made available to the Public. The Agency states that it recognises these issues will have to be addressed at some unspecified point in the future, but that in general they consider plans for dealing with them are adequate. In the NFLA view, this kind of 'pretend' consultation is unacceptable. It makes it difficult to fully respond to the consultation without knowing this important information – what are the unspecified issues?*'

127 Section 3.3 of the disposability assessment report does not refer to any issues '*that the EA has raised with the nuclear industry*' – this section refers to the issues RWMD have raised in Appendix B of their disposability assessment and to a few additional issues raised by EDF and AREVA in their critique of the disposability assessment. EDF and AREVA have published the full disposability assessment, including Appendix B and their critique on their web site.

128 Nuclear Waste Advisory Associates (GDA133) and the UK and Ireland Nuclear Free Local Authorities (GDA82), both provided the following comment on waste in their responses: '*To predict the contamination of water or gas that could leak from a nuclear disposal facility, the chemical characteristics and surroundings of the radioactive atoms must be known. However, inventory information set out in the NDA 'Disposability Assessment' reports is limited to information on the 'atom type' (the 'isotopes') alone – not the characteristics and chemical surrounding of these atoms. The critical importance of this type of information may be appreciated by comparing the solubility of carbon in a diamond and carbon in sugar. In one chemical form the carbon will not dissolve at all – whilst in the other form the carbon is completely soluble. Although there is some mention in the Disposability Assessments of the presence of materials such concrete and cellulose that would affect the chemical environment, to all intents and purposes, the information required is simply absent. Therefore, there is no way in which the NDA would be able to realistically predict how contaminated the leaks for a nuclear dump would be. This means their risk calculations do not reflect the reality*.'

129 RWMD's assessments of post-closure impact from disposed wastes are based on assumptions about the physical and chemical forms of waste, which are in turn based on knowledge of the materials making up the wastes and their proposed conditioning and packaging. Potential release rates of radionuclides from the wastes, either in groundwater or as gases, are estimated from either detailed modelling of the evolution of the chemical environment of the GDF (based on the

expected materials and conditions) or on simplified – generally pessimistic – models informed by more complex analysis of the chemistry. The behaviour of radionuclides in solution in groundwater or as a gas also takes account of the chemistry, and where there is real doubt about the chemical form, the form leading to the highest impact is typically assumed.

130 The UK and Ireland Nuclear Free Local Authorities (GDA82) provided the following comments on waste disposal in their response and the Nuclear Waste Advisory Associates (GDA133) provided very similar ones:

a) *'The EA has set a limit on the risk that may be caused by the burial of radioactive wastes of 10^{-6} yr^{-1} (i.e. one person in a million per year contracting a fatal cancer, a non-fatal cancer or inherited genetic defect as a result of radiation exposure). In comparison the NDA calculates the dose from the spent fuel arising from 6 new EPR reactors (almost 10GW) would be more than half this total risk. As the Agency points out: "...this does not leave a large margin to the regulatory risk guidance level". The (November 2009) Draft "Nuclear National Policy Statement" (27) proposed ten reactors sites, each with up to two reactors. Thus, in addition to current wastes, the wastes from up to 20 new reactors would need to be considered. The assumption that the nuclear industry may meet the regulatory target of a 'one in a million' risk simply by beginning the construction of an additional disposal facility cannot be legitimate. A second dump would result in double the original dose – even if this was spread geographically. It should also be noted that a large number of problems have been identified with the NDA's disposal project indicating that the NDA dose figures represent an extreme underestimate. For example, in March 2010 Nuclear Waste Advisory Associates (NWAA) compiled a register of current technical issues which remain to be resolved if a technical case for radioactive waste disposal is to be made. Over one hundred issues were identified. The EA simply states that: "At the time of disposal it will need to be confirmed by the GDF [disposal facility] licensee that the performance of the GDF with its whole inventory will be consistent with our risk guidance level". At present it is quite apparent the nuclear industry would not be able to 'dispose' of new build reactor wastes safely. It would be wholly irresponsible to wait until such wastes are created to confirm this. Unless and until the nuclear industry are able to demonstrate that new reactor wastes could be disposed of safely there should be no further steps taken towards the development of new reactors'.*

b) *'The Environment Agency's 'generic' evaluation of new reactor wastes prior to construction is meant to avoid a similar situation re-occurring. The Government says that potential new reactor developers have made clear they want national issues to be dealt with in advance of a public inquiry otherwise they will not consider investing in new nuclear power stations. Similarly, the Environment Agency says a key objective of utility companies is that uncertainties associated with regulatory matters are reduced so they can make well informed commercial decisions. The Environment Agency oversees waste issues associated with the nuclear industry, including nuclear waste 'disposal'. The NFLA would have been expected, therefore, that the Agency would look in some detail at the disposability of spent fuel from new reactors. The NDA's Radioactive Waste Management Division (RWMD) has produced reports on behalf of the nuclear industry on the disposability of nuclear waste and spent fuel arising from both EPR and AP1000 reactors. The nuclear vendors, or Requesting Parties (RPs) as they are known, responded to RWMD's Disposability Assessments. Yet the EA's consideration of this issue in the Consultation Document covers just seven out of over 170 pages. The report highlights several technical issues that are not fully resolved. Crucially, the EA has already stated that it is not known whether or not it will be possible to safely 'dispose' of waste fuel. But, in effect, the Agency postpones these outstanding disposability issues to some unspecified time in the future. The EA has produced additional 'assessment'*

reports on waste fuel and also the disposability of Intermediate Level Wastes (ILW) and waste fuel. These reports also indicate the EA plans to postpone the question of whether or not safe disposal is achievable. The EA states that it expects EDF: "...to identify at least one complete credible route by which the higher activity wastes from a fleet of UK EPRs could be safely disposed of and to provide grounds for reasonable confidence that the route(s) could be followed successfully." It is difficult to see how such a 'credible route' can be identified at this stage when the NDA's RWMD has yet to publish its draft safety case for the GDF, and when there are so many unresolved uncertainties regarding the deep geological disposal of nuclear waste. The fact that the outcome of future research may be that wastes cannot be 'disposed' of safely has been referred to extensively by the EA. It is imperative this issue is resolved prior to the expenditure of billions of pounds on reactor construction. If the nuclear industry is not required to prove they have a safe disposal route for wastes until after the planned reactors are built, then a powerful financial momentum would be created towards allowing the reactors to operate – and so produce waste fuel for which there was no long term safe management route. This should be a 'deal-breaker' for new reactors yet the EA simply chooses to postpone the problem until some unspecified time in the future. This is wholly irresponsible.'

c) *'For both types of reactor, the EA propose to issue an interim certificate to state the designs are 'acceptable' – pending the resolution, at some stage, of the 'disposability' issue. What the NDA's has called "disposability assessments" were relied upon by the Government to reach the conclusion that it was "satisfied that effective arrangements will exist to manage and dispose of the waste that will be produced from new nuclear power stations." The NDA argues that – because it would not be able to use a site for disposal unless it was approved by the regulators, then - necessarily - the chosen site would meet regulatory standards. Of course, this argument does not follow. It is possible the NDA could select a site, but be unable to meet the necessary standards. There has been a precedent for this in the rejection of the site proposed in the 1990s, partly for generic technical reasons, but partly for site-specific reasons. In March 2010, the House of Commons Energy and Climate Change Select Committee stated: "…the Government has no choice but to find a solution [for nuclear wastes], regardless of a decision on nuclear new build [and] waste arising from new nuclear power stations will not pose a significant additional challenge in terms of finding a permanent storage solution." This 'King Canute' argument that because the waste problem exists, the Government must be able to solve it, similarly makes no sense. Clearly, just because radioactive waste exists, it does not necessarily follow that it will be possible to safely dispose of it. The must make it clear that it rejects both of these arguments. There is no safe disposal route available for new reactor wastes, therefore the Agency must refuse to authorise its creation.*'

d) *'The EA Assessment Reports fail to fully analyse the NDA's 'Disposability Assessment' reports and the Requesting Parties responses. Instead they postpone dealing with outstanding disposability issues to some unspecified time in the future. This is unacceptable'*

e) *'The consultation documents fail to acknowledge other work by the EA which states that it is possible that an acceptable safety case for a GDF cannot be made.'* The Nuclear Consultation Group (GDA149) also quoted this from NFLA.

131 We are familiar with the NWAA's list of issues, and aware that RWMD are discussing with NWAA their responses to them, and we have ourselves raised many issues with Nirex and RWMD over the years. As stated above, the Nuclear NPS confirms that the Government is satisfied that effective arrangements will exist to manage and dispose of the waste that will be produced by new nuclear power stations in the UK. We also note that the Government base case for new build is that a facility for long term storage of high level waste and spent fuel will be

available in time to receive the wastes from new reactor build. As mentioned above, we have received additional information from EDF and AREVA in January 2011 (see 'EDF and AREVA documentation' section). We have assessed this further information and have identified the following assessment finding: The future operator shall provide confidence that adequate RWMCs, supported by appropriate stage LoCs, can be developed for all ILW on the timescales identified in EDF and AREVA's plan for disposability of ILW (UK EPR-AF10).

132 The Institution of Mechanical Engineers (GDA145) provided the following response to our consultation: '*Notwithstanding that the Generic Design Assessment is not intended to cover Site Specific Issues the potential for adjacent nuclear facilities to provide storage of radioactive waste and monitoring of radioactive waste discharges should be recognised*.'

133 Adjacent facilities are outside the scope of GDA. However, we would encourage operators to work with adjacent operators where they exist to reuse existing facilities.

134 NNB Genco (GDA106) provided the following response:

a) *'We welcome the Environment Agency's conclusions on solid radioactive waste, that all waste streams have been identified and that proven and recognised treatment and conditioning techniques will be used. NNB GenCo will work with RWMD and regulators to ensure that conditioning of ILW does not foreclose options until a Letter of Compliance (LoC) has been approved which demonstrates that packages will be disposable following long term interim storage'*

b) *'We welcome the Environment Agency's conclusion that Intermediate Level Waste (ILW) from a fleet of UK EPRs would be disposable in a suitably designed and located UK Geological Disposal Facility (GDF), subject to a satisfactory demonstration that spent fuel can be stored safely for the necessary period of time without significant degradation. This is in accord with the evidence provided by the Requesting Parties. Outside of the GDA process, prospective operators including NNB GenCo are already working with the Radioactive Waste Management Directorate (RWMD) to progress key issues, including the duration of interim storage prior to emplacement and the optimisation of the GDF design for both legacy and new build waste. These are operator and site specific issues, and we do not believe it is appropriate for the Requesting Party to seek further commitments from RWMD as part of the GDA process beyond the disposability assessment that has already been provided. We recognise that prospective operators will need to continue to work closely with regulators and RWMD as the design of the GDF develops, so as to ensure that conceptual Letters of Compliance are in place at the appropriate time*'.

135 Horizon Nuclear Power (GDA127) provided the following response with respect to the issues raised in our consultation document on ILW:

a) '*The disposability of ILW following longer term interim storage. We are confident that it will be possible to conclude that ILW can be safely stored over the longer term and that it will then be possible to dispose of it. Many thousands of packages of legacy ILW at Nuclear Decommissioning Authority (NDA) owned sites have already been prepared with the expectation that these will be disposable and the NDA / Radioactive Waste Management Division (RWMD) has issued Letters of Compliance to provide confidence that this will be the case. Horizon recognises that it will need to continue to engage with the RWMD to obtain appropriate Letters of Compliance for our site specific proposals.'*

b) *'Evidence during site-specific permitting that specific arrangements for minimising the disposals of LLW and ILW are BAT: Horizon is aware that during site-specific permitting it will need to present information to demonstrate BAT. Minimising the disposals of LLW and ILW is intimately linked with how the*

reactor is operated, what discharge abatement technology is deployed and what conditioning and packaging technologies are used. Minimising the quantities of waste for disposal is not something that can be targeted in isolation but will instead be a balance between a number of competing issues such as operator doses and environmental discharges.'

136 The Regulators received additional information from EDF and AREVA in January 2011 (see 'EDF and AREVA documentation' section) that we have assessed and this is discussed above. We agree that operators should use BAT to achieve a high degree of protection of the environment, taken as a whole and to meet the principle of optimisation.

137 Several respondents, including; individual respondents (GDA25, GDA84), the Nuclear Technology Subject Group of the Institution of Chemical Engineers (GDA67),Springfields Site Stakeholder Group (GDA96), Horizon Nuclear Power (GDA127) and the Institution of Mechanical Engineers (GDA145) said that they were satisfied with our conclusions on solid radioactive waste.

138 The Nuclear Technology Subject Group of the Institution of Chemical Engineers (GDA67) noted that the uncertainty regarding disposability of long-term stored ILW is a generic UK issue rather than a design specific or site-specific issue.

139 The Institution of Mechanical Engineers (GDA145) said that they fully support the requirement for the assessment of disposability of ILW following longer term interim storage pending disposal as the uncertainty surrounding the ILW repository means we must have assurance of the efficacy of long term interim storage. Again, as stated above, the Regulators received additional information from EDF and AREVA in January 2011 (see 'EDF and AREVA documentation' section) that we have assessed and this is discussed above.

140 **We conclude that:**

a) **EDF and AREVA have identified all ILW waste streams that a UK EPR will typically produce.**

b) **The UK EPR uses BAT to minimise the arisings of ILW, subject to assessment finding UK EPR-AF11.**

c) **The UK EPR uses BAT to treat and condition ILW prior to disposal, subject to assessment finding UK EPR-AF12.**

d) **On the basis of the information provided for GDA, we see no reason at this stage to believe that any of the ILW from a UK EPR will not be disposable in a suitably designed and located GDF. The UK EPR is not expected to produce ILW for which there is no foreseeable disposal route.**

e) **In due course, we will need to see more definitive assessments to confirm how all of the ILW will be conditioned for disposal, that the selected conditioning methods represent the application of BAT, and that in their conditioned forms the ILW will continue to be disposable. Hence, the future operator should provide confidence that adequate RWMCs, supported by appropriate stage LoCs, can be developed for all ILW on the timescales identified in EDF and AREVA's plan for disposability of ILW (UK EPR-AF10).**

f) **EDF and AREVA have provided valid estimates for the annual arisings (during operations and decommissioning) of ILW. These arisings (during operations) are consistent with those of comparable reactors around the world (Isukul, 2009). The arisings of ILW are below the European Utility Requirement (European Utility Requirements for LWR Nuclear Power Plants Rev C Apr 2001 (Volume 2 chapter 2, section 5.2)) objective of less than or equal to 50 m^3 per 1000 MWe plant-year of operation.**

3.7 Supporting visits

141 The PCER and supporting documents identify a number of options for operating the UK EPR that are relevant to our assessment on LLW and ILW. 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.

142 During GDA, sites were visited 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.

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

3.8 Compliance with our REPs

144 The following REPs were considered in our assessment of EDF and AREVA's LLW and ILW:

a) 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.

b) Principle RSMDP8 – Segregation of wastes: The best available techniques should be used to prevent the mixing of radioactive substances with other materials, including other radioactive substances, which might where such mixing compromise subsequent effective management or increase environmental impacts or risks.

c) Principle RSMDP9 – Characterisation: Radioactive substances should be characterised using the best available techniques so as to facilitate their subsequent management, including waste disposal.

d) Principle RSMDP10 – Storage: Radioactive substances should be stored using the best available techniques so that their environmental risk and environmental impact are minimised and that subsequent management, including disposal is facilitated.

e) Principle RSMPD15 – Requirements and conditions for disposal of wastes: Requirements and conditions that properly protect people and the environment should be set out and imposed for disposal of radioactive waste. Disposal of radioactive waste should comply with imposed requirements and conditions.

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

REP number	REP title & Information in submission
RSMDP3	**Use of BAT to minimise waste** See descriptions in 'Management and disposal of low level waste' and 'Management and disposal of intermediate level waste' sections above. EDF and AREVA have provided basic evidence of how they will minimise the quantities of LLW and ILW needing disposal. This includes appropriate characterisation and segregation. The UK EPR uses BAT to minimise the arisings of LLW and ILW, and to treat and condition LLW and ILW prior to disposal. However, during the detailed design phase, the future operator shall provide evidence that the proposed specific techniques for preventing and, where that is not possible minimising the creation of LLW and ILW are BAT (UK EPR-AF11) and that the proposed specific techniques for treating and conditioning of LLW and ILW before disposal are BAT (UK EPR-AF12). We accept that LLW and ILW will be treated and conditioned using proven and recognised techniques.
RSMDP8	**Segregation of wastes** EDF and AREVA state in PCERsc6.2 that solid radioactive waste is segregated at source in each area as it arises, both in terms of activity and its chemical and physical characteristics (i.e. combustible, compactable and non-combustible /non-compactable).
RSMDP9	**Characterisation** See 'RSMDP3' and 'RSMDP8' above.
RSMDP10	**Storage** See descriptions in 'Management and disposal of low level waste' and 'Management and Disposal of intermediate level waste' sections above. EDF and AREVA have described their buffer storage arrangements for LLW and their storage arrangements for ILW prior to disposal.

REP number	REP title & Information in submission
RSMPD15	**Requirements and conditions for disposal of wastes** See descriptions in 'Management and disposal of low level waste' and 'Management and disposal of intermediate level waste' sections above. The design is not expected to produce LLW for which there is no foreseeable disposal route. EDF and AREVA have demonstrated that the waste streams would meet the criteria for disposal in a LLW facility. If smelting of any LLW is pursued, the future operator shall demonstrate that the conditions of acceptance of the selected smelting facility can be met (UK EPR-AF13). If incineration of any LLW is pursued, the future operator shall demonstrate that the conditions of acceptance of the selected incineration facility can be met (UK EPR-AF14). The design is not expected to produce ILW for which there is no foreseeable disposal route. If incineration of any ILW is pursued, the future operator shall demonstrate that the conditions of acceptance of the selected incineration facility can be met (UK EPR-AF15). ONR has reviewed information on long-term storage of ILW in its Step 4 assessment. EDF and AREVA have obtained and provided a view from the NDA (as the UK authoritative source in providing such advice) on the disposability of their proposed arisings of ILW. RWMD concluded that compared with legacy wastes, no new issues arise that challenge the fundamental disposability of the wastes expected to arise from operation of the UK EPR. The future operator shall provide confidence that adequate RWMCs, supported by appropriate stage LoCs, can be developed for all ILW on the timescales identified in EDF and AREVA's plan for disposability of ILW (UK EPR-AF10). Further information on the disposability of ILW can be found in our assessment report on disposability of ILW and spent fuel (Environment Agency, 2011d).

3.9 Compliance with Table 1 in our Process and Information Document

145 Sections 2.1, 2.4 and 1.5 in Table 1 of the P&ID were considered in our assessment of EDF and AREVA's LLW and ILW. The table below summarises whether these requirements have been addressed in EDF and AREVA's submission:

Section number	Description of requirement & Information in submission
2.1	**A description of how radioactive wastes will arise, be managed and disposed of throughout the facility's lifecycle.** See 'Creation of solid waste' section above. This shows that EDF and AREVA have provided a description of how radioactive solid wastes will arise. All LLW and ILW waste streams that a UK EPR will typically produce have been identified by EDF and AREVA. See 'Management and disposal of low level waste' and 'Management and disposal of intermediate level waste' sections above. This shows that EDF and AREVA have provided a description of how radioactive solid wastes will be managed and disposed of. The design is not expected to produce LLW for which there is no foreseeable disposal route. EDF and AREVA have demonstrated that the waste streams would meet the criteria for disposal in a LLW facility. If smelting of any LLW is pursued, the future operator shall demonstrate that the conditions of acceptance of the selected smelting facility can be met (UK EPR-AF13). If incineration of any LLW is pursued, the future operator shall demonstrate that the conditions of acceptance of the selected incineration facility can be met (UK EPR-AF14). The design is not expected to produce ILW for which there is no foreseeable disposal route. If incineration of any ILW is pursued, the future operator shall demonstrate that the conditions of acceptance of the selected incineration facility can be met (UK EPR-AF15). ONR has reviewed information on long-term storage of ILW in its Step 4 assessment. EDF and AREVA have obtained and provided a view from the NDA (as the UK authoritative source in providing such advice) on the disposability of their proposed arisings of ILW. RWMD concluded that compared with legacy wastes, no new issues arise that challenge the fundamental disposability of the wastes expected to arise from operation of the UK EPR. The future operator shall provide confidence that adequate RWMCs, supported by appropriate stage LoCs, can be developed for all ILW on the timescales identified in EDF and AREVA's plan for disposability of ILW (UK EPR-AF10). Further information on the disposability of ILW can be found in our assessment report on disposability of ILW and spent fuel (Environment Agency, 2011d). EDF and AREVA have considered decommissioning radioactive solid waste.

Section number	Description of requirement & Information in submission
2.4	**Design basis estimates and substantiation of annual arisings of solid radioactive waste during operation and decommissioning. Wastes should be identified in terms of category (HLW, ILW, LLW), physico-chemical characteristics and proposed disposal route (if any). Quantification should be in terms of activity of key individual radionuclides and overall groupings of radionuclides (e.g. total alpha), mass and volumes.** See 'Creation of solid waste', 'Management and disposal of low level waste' and 'Management and disposal of intermediate level waste' sections above This shows that EDF and AREVA have provided estimates of annual arisings of solid radioactive waste during operation and decommissioning. Wastes have been identified in terms of category, physico-chemical characteristics and proposed disposal route. Quantification is in terms of activity of key individual radionuclides and overall groupings of radionuclides (e.g. total alpha), mass and volumes. The estimates in EDF and AREVA's submission for the volumes of LLW and ILW are reasonable for the UK EPR. These estimates were derived by EDF and AREVA using 15 years worth of waste arisings data from across the whole French fleet as detailed in TQ-ERR-159 and TQ-EPR-124. The supplementary information given in TQ-EPR-470 provides confidence that the estimates are realistic for the UK EPR. The estimates used data from the EDF tracking system which records the characteristics of every solid waste package produced on the 19 sites in France (PCERsc6.3s3.1). The Environment Agency and HSE attended a presentation by EDF in September 2009 on their processes for recording and analysing information on radioactive wastes at their sites to gain further confidence. These arisings of LLW and ILW are consistent with those of comparable reactors around the world (Isukul, 2009). The arisings of LLW and ILW are below the European Utility Requirement objective of less than ≤ 50 m^3 per 1000 MWe plant-year of operation (EUR, 2001).
2.4	**The requesting party should obtain, and provide, a view from the Nuclear Decommissioning Authority (NDA) (as the UK authoritative source in providing such advice) on the disposability of any proposed arisings of ILW.** See descriptions in 'Management and disposal of low level waste' and 'Management and disposal of intermediate level waste' sections above. EDF and AREVA have obtained and provided a view from the NDA (as the UK authoritative source in providing such advice) on the disposability of their proposed arisings of ILW. RWMD concluded that compared with legacy wastes, no new issues arise that challenge the fundamental disposability of the wastes expected to arise from operation of the UK EPR. Further information on the disposability of ILW can be found in our assessment report on disposability of ILW and spent fuel (Environment Agency, 2011d).

Section number	Description of requirement & Information in submission
1.5	**An analysis should be provided that includes an evaluation of options considered and shows that the best available techniques will be used to minimise the production and discharge or disposal of waste.** See descriptions in 'Management and disposal of low level waste' and 'Management and disposal of intermediate level waste' sections above. EDF and AREVA have provided basic evidence of how they will minimise the quantities of LLW and ILW needing disposal. This includes appropriate characterisation and segregation. The UK EPR uses BAT to minimise the arisings of LLW and ILW, and to treat and condition LLW and ILW prior to disposal. However, during the detailed design phase, the future operator shall provide evidence that the proposed specific techniques for preventing and, where that is not possible minimising the creation of LLW and ILW are BAT (UK EPR-AF11) and that the proposed specific techniques for treating and conditioning of LLW and ILW before disposal are BAT (UK EPR-AF12). We accept that LLW and ILW will be treated and conditioned using proven and recognised techniques.

4 Public comments

146 One comment on ILW was received from the public involvement process relating to the UK EPR design during our detailed assessment stage. The comment asked whether the UK EPR design adequately caters for the encapsulation, storage and disposal of ILW. EDF and AREVA responded with information that is available in their submission, that is that ILW is encapsulated in concrete containers and that final ILW packages will be placed in an interim storage facility before their disposal in the proposed GDF.

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

5 Conclusion

148 Our conclusions are unchanged since our consultation, however, we have reworded our assessment findings and added additional ones on; arisings of LLW and ILW, and incineration of ILW.

149 **We conclude that:**

a) **EDF and AREVA have identified all low level waste (LLW) and intermediate level waste (ILW) waste streams that a UK EPR will typically produce.**

b) **The UK EPR uses BAT to minimise the arisings of LLW and ILW, subject to assessment finding UK EPR-AF11.** Prior to consultation we only proposed an assessment finding relating to the disposal of LLW and ILW (UK EPR-AF12, below).

c) **The UK EPR uses BAT to treat and condition LLW and ILW prior to disposal, subject to assessment finding UK EPR-AF12.**

d) **The UK EPR is not expected to produce LLW or ILW for which there is no foreseeable disposal route.**

e) **EDF and AREVA have provided valid estimates for the annual arisings (during operations and decommissioning) of LLW and ILW. These arisings (during operations) are consistent with those of comparable reactors around the world (Isukul, 2009).**

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

a) The future operator shall provide confidence that adequate radioactive waste management cases (RWMCs), supported by appropriate stage Letters of Compliance (LoCs), can be developed for all intermediate level waste (ILW) on the timescales identified in EDF and AREVA's plan for disposability of ILW. (UK EPR-AF10)

b) The future operator shall provide evidence during the detailed design phase that the proposed specific techniques for preventing and, where that is not possible, minimising the creation of low level waste (LLW) and intermediate level waste (ILW) are the best available techniques (BAT). (UK EPR-AF11)

c) The future operator shall provide evidence during the detailed design phase that the proposed specific techniques for treating and conditioning of low level waste (LLW) and intermediate level waste (ILW) before disposal are the best available techniques (BAT). (UK EPR-AF12)

d) If smelting of any low level waste (LLW) is pursued, the future operator shall demonstrate that the conditions of acceptance of the selected smelting facility can be met. (UK EPR-AF13)

e) If incineration of any low level waste (LLW) is pursued, the future operator shall demonstrate that the conditions of acceptance of the selected incineration facility can be met. (UK EPR-AF14)

f) If incineration of any intermediate level waste (ILW) is pursued, the future operator shall demonstrate that the conditions of acceptance of the selected incineration facility can be met. (UK EPR-AF15).

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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

BAT	Best available techniques
BNI	Balance of nuclear island
CFA	Conditions for acceptance
CVCS	Chemical and volume control system
DAW	Dry active waste
EPRB	GDA UK EPR – BAT demonstration, document UKEPR-0011-001 issue 03
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
HHISO	Half height ISO
HLW	High level waste
HSE	The Health and Safety Executive
ILW	Intermediate level waste
IWS	GDA UK EPR – Integrated waste strategy document UKEPR-0010-001 issue 02
LLW	Low level waste
LLWR	The national Low level waste repository, near Drigg, Cumbria
MRWS	Managing Radioactive Waste Safely
NAB	Nuclear auxiliary building
NDA	Nuclear Decommissioning Authority
NRC	The United States Nuclear Regulatory Commission
ONR	Office for Nuclear Regulation, an Agency of the HSE (formerly HSE's Nuclear Directorate)
P&ID	Process and information document
PCER	Pre-construction environmental report
PCERsc3.3s4.1	PCER sub-chapter 3.3 section 4.1 (example reference)
PWR	Pressurised water reactor
RCCAs	Rod cluster control assemblies
REPs	Radioactive substances environmental principles
RI	Regulatory issue
RO	Regulatory observation
RP	Requesting party
RWMD	Radioactive Waste Management Directorate (of NDA)
SEPA	Scottish Environment Protection Agency
SGBS	Steam generator blow down system

SRWSR	Solid radioactive waste strategy report
STUK	Säteilyturvakeskus - The Radiation and Nuclear Safety Authority of Finland
TES	Solid waste treatment system
TQ	Technical query
VLLW	Very low level waste

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