F-3.4.1-1 Rev 6

DOCUMENT COVER SHEET

TDC: ______ Permanent File: ______

DOCUMENT NO. UKP-GW-GL-055	REVISION 2	PAGE 1 of 73	ASSIGNED TO W-Russ	OPEN ITEMS (Y/N) N

DOCUMENT STATUS: ☐ PRE ☐ CFC ☐ CAE ☒ DES

Westinghouse Acceptance of AP1000 Design Partner Document by:

N/A

(Name and Date)

ALTERNATE DOCUMENT NUMBER: N/A

WORK BREAKDOWN #: GW

ORIGINATING ORGANIZATION: Westinghouse Electric Company LLC

TITLE: **UK AP1000 Radioactive Waste Management Case Evidence Report for Intermediate Level Waste**

ATTACHMENTS: N/A	DCP/DCA/SUPPLEMENTS/EDCR # INCORPORATED IN THIS DOCUMENT REVISION: N/A
CALCULATION/ANALYSIS REFERENCE: N/A	

ELECTRONIC FILENAME	ELECTRONIC FILE FORMAT	ELECTRONIC FILE DESCRIPTION
UKP-GW-GL-055.doc	Word	

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Plant Applicability: ☐ All AP1000 plants except:
☒ Only the following plants: UKP

APPLICABILITY REVIEWER WEC 6.1.pdf N/A	SIGNATURE/DATE N/A
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UK AP1000 Radioactive Waste Management Case Evidence Report for Intermediate Level Waste

UKP-GW-GL-055, Revision 2

Westinghouse Electric Company LLC
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REVISION HISTORY

Revision	Description of Change
0	Initial Submittal
1	Complete rewrite. Revised in-line with current Guidance (February 2010) and comments from ROA-AP1000-34.A5 (31 August 2010).
2	Revised in-line with new Long Term Storage of Waste document UKP-GW-GL-085.

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1. EXECUTIVE SUMMARY

This document has been prepared for the Generic Design Assessment (GDA)[1] of the Westinghouse AP1000™ Nuclear Power Plant (NPP). The generic nature of the current assessment phase means that specific and detailed radioactive waste management cases (RWMCs) cannot yet be fully developed. Therefore, it is a requirement to demonstrate that sufficient detailed information will be available to allow the necessary RWMCs to be developed. Some of the required information is available now; other information will become available as the AP1000 designs, management systems, and operating procedures are further developed to suit a specific site and the associated licencing process. The information contained herein is consistent with the level of detail required at this stage of the GDA process.

This evidence report is presented to demonstrate that suitable RWMCs can be prepared by the site licensee in the future. The evidence takes the form of a series of statements plus references to supporting information. It is important to note that this evidence report is not an RWMC; rather, it is a key to the information required to produce the necessary RWMCs.

RWMCs will be prepared in accordance with the guidance issued by the Health and Safety Executive (HSE), the Environment Agency (EA), and the Scottish Environment Protection Agency (SEPA) (collectively referred to as "the regulators") [Ref. 1]. This guidance describes regulatory expectations with respect to the production, content, maintenance, and review of RWMCs, and provides links to further guidance that describes how the components of RWMCs can be produced.

This United Kingdom (UK) AP1000 RWMC evidence report addresses the intermediate level waste (ILW) stream arising from AP1000 operation, maintenance, and eventual decommissioning. The report concludes that there is sufficient information provided through the GDA process to allow licensees to produce a detailed RWMC for ILW during the site licensing phase.

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1. Glossary of Terms is found in Appendix 2.

2. OBJECTIVE AND SCOPE

The objective and scope of this document is to provide documentary evidence that sufficient information will be available to allow the preparation of UK AP1000 RWMCs for ILW by a specific site licensee. A companion document for high level waste (HLW) has been produced [Ref. 34].

This document also aims to identify the interdependencies between the major documents that will be issued as part of the GDA process to support the RWMC and to identify where additional detail is needed and how this additional detail will be developed (for example, during detailed design).

3. RELEVANT WASTES

Within the Regulators joint guidance for RWMCs [Ref. 1], higher activity radioactive waste is defined as: "HLW, ILW and such low level waste (LLW) as cannot be disposed of at present".

There is no LLW expected to be generated by future AP1000's that cannot be disposed of at present, therefore, for the AP1000, there are two types of final waste that the RWMCs must address:

- Solid ILW comprising spent ion exchange resin, activated carbon, primary circuit filters and ILW arising during decommissioning.

- Solid HLW comprising spent fuel.

For the GDA process, two UK AP1000 RWMC evidence reports have been produced. This document addresses the ILW stream(s). A companion document addresses the HLW stream [Ref. 34].

4. BACKGROUND

Westinghouse Electric Company LLC (Westinghouse) is seeking approval to have an AP1000 simplified passive advanced light water reactor electricity generating plant built in the United Kingdom. The UK Nuclear Regulators have developed a GDA process to endorse generic designs, enabling new build licensing to proceed more smoothly. Part of this process is to assess the management of radioactive materials on site and their eventual disposal. Recognised documents used in the industry to demonstrate effective management of radioactive waste are the Integrated Waste Strategy (IWS), Best Available Technique (BAT) studies and Radioactive Waste Management Cases (RWMC).

This document is the RWMC evidence report for ILW, and it has been prepared for the GDA. As explained earlier, this document is a key to information required to produce RWMCs. This information will be used by the operators of AP1000 on a specific site to prepare the necessary RWMC documents.

Guidance has been published from the Regulators on the management of higher activity radioactive waste on nuclear licensed sites [Refs. 1 and 2]. This guidance describes the regulatory expectations with respect to the production, content, maintenance, and review of an RWMC.

AP1000 RWMCs will address the longer term safety and environmental issues associated with a particular waste from generation to conditioning into the form in which it will be suitable for storage and eventual disposal.

Before reaching its final disposal or storage destination, AP1000 radioactive waste will be processed and transferred from the AP1000 to onsite storage facilities. The AP1000 and associated waste handling plants and the storage facility each have a nuclear safety case justifying its safe operation. Certain sections of these safety cases may cover, in whole or in part, the topics of concern to the AP1000 RWMCs.

It should be noted that the term “radioactive waste management case” is used as a construct to explain how information should be organised so that specific site licensee’s can demonstrate the long-term safety and environmental performance of higher activity wastes. Since AP1000 RWMCs form part of the overall safety case and the safety cases associated with storage facilities, they will be treated and managed as safety cases in terms of Licence Conditions 14, 15, and 19–22.

4.1 Applicable Legislation

Facilities and activities for predisposal management of radioactive waste, including decommissioning activities, are subject to safety and environmental impact assessments to demonstrate that they are adequately safe and, more specifically, that they will be in compliance with safety and environmental requirements established by the regulators. The relevant legislation to be complied with is listed below:

- Nuclear Installations Act 1965 (as amended)
- Standard license conditions applied to nuclear site licences and, in particular, those pertaining to the management of radioactive waste: License Condition (LC) 4, 32, 34, and 35. Also, because the RWMC is the safety case for management of a particular radioactive waste stream (or streams), LCs 14, 15 and 19-23 are also particularly relevant

- Health and Safety at Work Act 1974
- Environment Act 1995
- Radioactive Substances Act 1993

The guidance for the preparation of an RWMC [Ref. 1] also identifies that there may be other short-term environmental issues (such as discharges) that may be covered by separate environmental legislation. It is acknowledged that the RWMC may not be the best place to demonstrate compliance with this separate legislation, but licensees should refer to other environmental legislation to ensure that their radioactive waste management cases are consistent with it.

4.2 Radioactive Waste Management Case

The RWMCs that will be developed for the AP1000 will demonstrate the longer term safety and environmental performance of the planned management of specific wastes from generation to conditioning into the form which will be suitable for storage and eventual disposal. The RWMCs will provide a complete picture of the management of waste streams that cannot necessarily be seen from examination of the individual plant safety cases and environmental documentation. At each stage, the RWMCs will aim to ensure that radioactive waste is managed in a way that protects the health and interests of people and the integrity of the environment, both now and in the future, inspires public confidence and takes account of costs. The long timescales involved may mean that the RWMCs cannot cover all eventualities, and that some aspects may not yet be known. The RWMCs will make it clear how such uncertainties are being dealt with and refer to a programme of work, where appropriate, that is designed to address any gaps in knowledge.

4.2.1 Purpose

RWMCs developed for AP1000 will provide a transparent demonstration of adequate radioactive waste management for the waste stream(s) covered. They will provide support for safe operation by establishing and demonstrating that the plants, processes, activities, modifications, and the like, proposed for managing radioactive wastes:

- Comply with regulatory requirements.
- Provide for an acceptable outcome in terms of national policy for radioactive waste management.
- Are consistent with national and international standards of radioactive waste management.
- Take account of interdependencies among all steps in generation and management of radioactive waste.

The RWMCs will be used to ensure that local plant operations are fully integrated with the lifetime plans for the waste and the relevant aspects related to the site as a whole. In addition, the RWMCs will be a key input into design considerations of future waste processing and storage facilities. This will ensure that such facilities are compatible with the wastes they are intended to receive. This is particularly relevant to the mobile ILW waste processing facilities for the AP1000 because the national waste repositories are currently under consideration.

The RWMCs will also enable the following:

- Provide the context within which changes in plant safety cases must be reviewed.

- Provide information on operators' understanding and intentions with respect to radioactive waste management.

- Provide a means by which plant operators understand the significance of delivering specific strategies with respect to the safe management of radioactive waste.

- Aid training and awareness of personnel in the radioactive waste management aspects of the plant.

4.2.2 Content and Structure

AP1000 RWMCs will demonstrate the longer term safety and environmental performance of the planned management of specific wastes. Sections 5 through 10 of this report detail the information expected to appear in AP1000 RWMCs together with references to the supporting documentation from which information will be taken.

AP1000 RWMCs will demonstrate how, for example, the various plant safety cases and the IWS [Ref. 18] interact and will describe arrangements for managing such interactions. When the AP1000 RWMCs are developed, "gaps" in information or management arrangements may be identified. These gaps will be addressed in the RWMCs or in the safety cases as appropriate.

Although this evidence report addresses UK AP1000 ILW streams, the specific site licensee will determine how many RWMCs to produce in order to cover all relevant wastes. RWMCs will be produced for all higher activity waste arising from AP1000 operations, maintenance, and decommissioning.

The AP1000 RWMCs will comprise the top tier of a hierarchy of documents. This hierarchy is shown diagrammatically in Figure 4-1. It is important to note that this hierarchy specifically represents the structure of the AP1000 RWMCs and does not represent the hierarchy of documents for the AP1000 in general.

The RWMCs will describe the radioactive waste management process, present the main issues and the functions required to deliver an acceptable radioactive waste management outcome, explain the means of delivering these functions, and summarise the main conclusions. Detailed technical information and supporting analysis, which underpins the conclusions of the RWMC, will be contained in lower tier documents which will be clearly referenced within the RWMC and these references are summarised in Appendix 1. These may include the:

- European Design Control Document (DCD) [Ref. 16]
- Environment Report (ER) [Ref. 3]
- Integrated Waste Strategy (IWS) [Ref. 18]
- Pre-Construction Safety Report (PCSR) [Ref. 17]
- Life Cycle Safety Report (LCSR) [Ref. 28]
- Disposability Assessment (DA) [Ref. 27]
- Individual plant safety cases

4.2.3 Ownership

The AP1000 specific site licensee will have prime responsibility for radioactive waste management and compliance with licence conditions and will be legally responsible for the RWMC. As stated previously, some components of an RWMC may reside in plant safety cases, and these will be owned by those with direct responsibility for delivering safety for the AP1000 or the associated storage facilities.

The AP1000 specific site management system will ensure that there is adequate interaction between the individual plants or processes within the AP1000 involved in the radioactive waste management process.

The ownership and responsibility for the AP1000 RWMCs require:

- An understanding of the RWMC, the standards applied, its assumptions, and the limits and conditions derived from it.
- The technical capability to understand and act upon the RWMC work produced by others.
- The ability to use the RWMC to influence operational decisions to ensure acceptable management of radioactive waste.
- AP1000 plant operators should be involved in the preparation of an RWMC to ensure that it reflects operational needs and reality.

Management of transitions and changes of RWMC ownership from earlier to later stages of the lifecycle are important aspects of the development of the RWMC that need to be controlled. The AP1000 specific site management system should explain how relevant information and records are transferred and demonstrate that there are mechanisms in place to ensure that the RWMC is fully adopted and implemented.

4.2.4 Production

The responsibilities for production, revision, review, and document control will be clearly defined as part of licence compliance arrangements, and they will be discharged by suitably qualified and experienced people.

Preparation of AP1000 specific site RWMCs will commence at an early stage. A generic site IWS has been prepared [Ref. 18], and once the specific site development of this document commences, this will trigger the production of the AP1000 RWMCs. Other data from relevant safety cases will be added as they are developed.

Interdependencies are key to an RWMC. Some supporting components of this RWMC already exist as part of the GDA safety case (PCSR [Ref. 17]) and environmental case (Environment Report [Ref. 3]). The relevant sections have been referenced throughout this RWMC and these references are summarised in Appendix 1. The individual safety cases for the plant involved in the handling, conditioning, transportation and storage of higher activity radioactive waste have been incorporated into the PCSR [Ref. 17]. Aspects of the RWMC, such as the design of the spent fuel dry storage canisters and procedures for the final disposal of waste packages at the future HLW repository, will be informed by the future repository safety case. As the development of the RWMC progresses, supporting components will be reviewed, if necessary amended, and then referenced.

The AP1000 RWMCs will be clear and logically structured allowing the information to be readily accessible to those who need to use it. This includes operations, maintenance, technical personnel, and managerial staff; and also regulators and future operators of disposal facilities.

4.2.5 Proportionality in Production of RWMCs

RWMCs will be produced in a proportionate way. They will be fit for purpose, taking account of:

- The magnitude of the hazard presented by the waste. ILW resin is mobile and thus presents a significant hazard which will be reflected in the RWMC.
- The complexity of the operations involved. The handling and processing of mobile resin will involve multiple complex remote operations with multiple safety systems.
- The degree of challenge posed by the waste streams under consideration.
- The timescales over which waste management operations will take place.
- The consequences of work not being done, or being delayed.

4.2.6 Peer Review and Independent Assessment

As part of the production process, RWMCs will undergo appropriate review and approval processes to confirm, among other things, that:

- The case is complete and addresses all the relevant aspects outlined in Sections 5 to 10 of this evidence report;
- Key assumptions in the RWMC and supporting documentation have been validated and subject to a sensitivity check;
- Fit-for-purpose methods and data have been used;
- Calculations in the RWMC and supporting documentation have been checked for accuracy;
- The plant and operational details documented are consistent with the actual plant and its operations.

AP1000 licensee’s arrangements will also provide for the following additional processes:

- Independent assessment by suitably qualified and experienced assessors, who are independent of the authors and verifiers and those directly responsible for the plant’s operations;
- Consideration by the licensee’s Nuclear Safety Committee.

4.2.7 Maintenance

The AP1000 RWMCs will be considered living documents and will be reviewed and updated as necessary throughout the whole of the AP1000 lifecycle. The reviews and updates will take into consideration regulatory and legislative changes, amendments to site license conditions, improvements in waste handling technologies and processes, operational information obtained throughout the life of the plant and that from other similar operating units, and the like. Any changes will be subject to reviews with the level of review being appropriate to the safety significance of the change so that the specific and wider consequences of the modification, including retrieval and disposal, are adequately assessed. The RWMC maintenance process should ensure that a review of possible consequences of a foreseen modification or change in one facility will not adversely impact the operability or safety of associated or adjacent facilities.

The AP1000 RWMCs will be subject to review where:

- New information becomes known on referenced data and information that underpins analyses and assumptions in the current RWMC.
- The outcome of any reviews of the IWS would significantly change the basis of the RWMC.
- Changes are suggested or new information arises from operating experience, examination, or testing results, updated design, analysis methods, research findings, or other sources.
- The outcome from major periodic and interim safety reviews (Licence Condition 15) suggests the need for changes.
- Changes that arise from time-dependent degradation.

No modification of the AP1000 radioactive waste management plant or processes will take place without a review of the RWMCs. Documentation that no longer forms part of a current RWMC, or which has been superseded, will be identified and archived and will form part of the formal historical record. It will remain subject to the arrangements made under Licence Condition 6.

4.2.8 Periodic Review of Safety Cases and Implications for RWMCs

Licence Condition 15 requires that: “the licensee shall make and implement adequate arrangements for the periodic and systematic review and reassessment of safety cases.” This Licence Condition ensures that throughout its life, each plant remains adequately safe and that its safety case is kept up to date [Ref. 1].

Specifically with respect to waste management aspects, the reviews will also include:

- Consideration of the acceptance criteria and the limits for deviation from these criteria during storage.
- Any changes in the basis for interdependencies between waste management steps.

Most of the components of the AP1000 RWMC will form part of individual plant safety cases and will be part of such reviews. Arrangements will be in place to ensure that when a component of the RWMC is reviewed as part of a plant safety case review, it will be in the context of the whole RWMC.

Additionally, the AP1000 RWMCs as a whole will be periodically reviewed ensuring that they remain consistent and that modifications have been fully considered in the context of the overall radioactive waste management process. Such reviews are required to be undertaken no less than every 10 years.

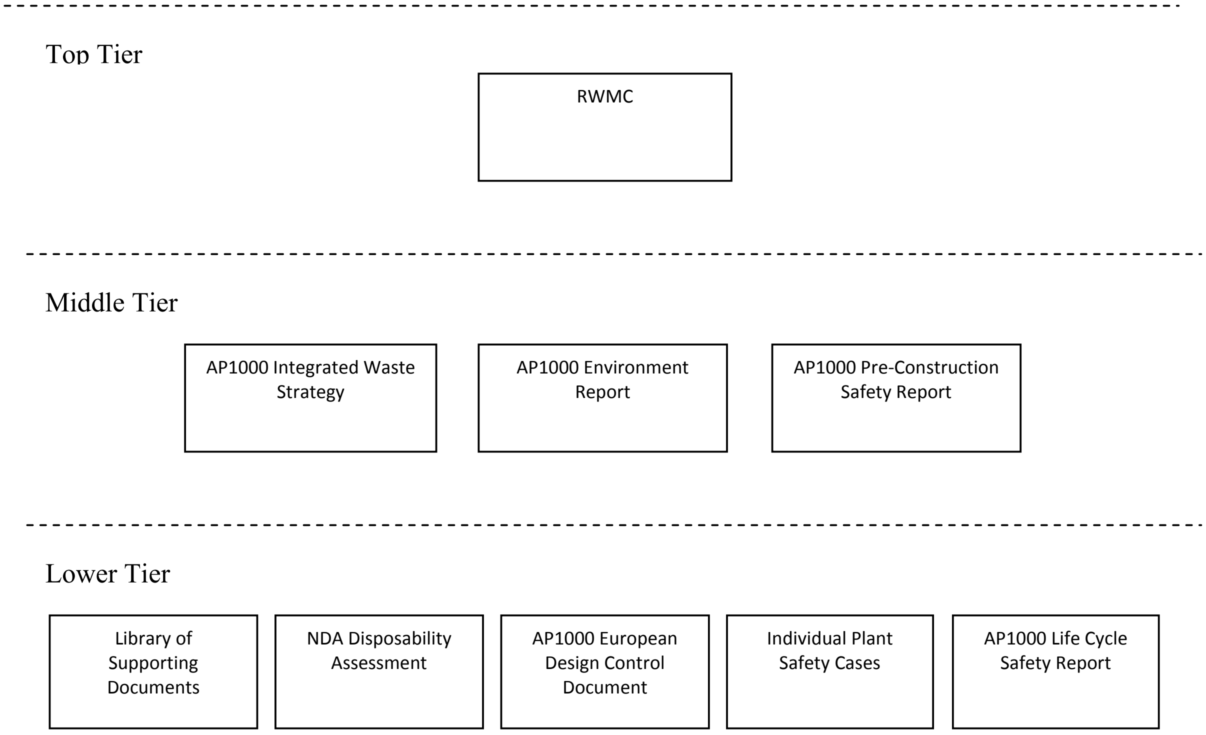

Figure 4-1. AP1000 RWMC Waste Management Document Hierarchy[2]

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[2] The evidence report also adopts this document hierarchy with the evidence report replacing the RWMC as the top tier document.

5. GENERAL REQUIREMENTS

5.1 Waste Streams

Summaries on the source of arising, characteristics, inventory, and quantities of the applicable waste streams are in section 3 and Appendix A of the ER [Ref. 3]. This is to be used as the definitive waste inventory.

Additional information on the specific waste streams can also be found in the DCD [Ref. 16], and the "Process Mass Balance" [Ref. 15] and the "Solid Waste Activity Calculation" [Ref. 38].

Westinghouse has asked the RWMD to consider the option of disposing of ILW rod cluster control assemblies and certain other core components (e.g., burnable poisons and thimble plugs) within the spent fuel assemblies as practiced elsewhere in the world to minimise handling and to avoid production of orphan wastes [Ref. 34]. When completed, the conclusions of that study will be incorporated into applicable documents.

5.2 Current Ownership of the Waste Streams

The future AP1000 licensee will be the owner of the waste streams, from the processing and packaging through interim storage until final disposal at a future national repository. Some contractor activities during commissioning and decommissioning may involve the generation and handling of ILW, however the licensee will remain the owner of the waste stream.

5.3 Management Strategy for the Waste Streams

The strategy for the management of radwaste is being planned with the expectation that the LLW, ILW, and spent fuel waste streams will be capable of being disposed in Nuclear Decommissioning Authority (NDA) facilities. Waste forms and treatment processes have been selected with this principle in mind. To ensure the waste packages are disposable, Radioactive Waste Management Directorate (RWMD) compliant containers have been designated (refer to section 3.5.1 of the ER [Ref. 3]).

Westinghouse has initiated discussions regarding the disposability of radwaste with the EA and the UK NDA, and will continue this dialogue. Westinghouse has provided the NDA with information relating to the wastes that are expected to arise over the lifetime of an AP1000 [Ref. 35]. The NDA used this information as the basis for a disposability assessment report covering ILW and HLW generated by the AP1000 [Ref. 27]. This report concluded that "compared with legacy wastes and existing spent fuel, no new issues arise that challenge the fundamental disposability of the wastes and spent fuel expected to arise from operation of such a reactor."

Uncertainties and risks relating to the achievement of this strategy will be identified as the strategy is implemented and managed by documenting and discussing them with the utility customers and the EA. The main uncertainty, risk, and assumptions in this strategy are associated with radioactive waste and spent fuel disposal in line with the NDA. At this time, the NDA is not able to provide information on the ILW packages they will accept; therefore, Westinghouse will assume that current practices for packaging ILW in RWMD packages remain acceptable once the AP1000 is built and operating. This includes package designs and sizes, and acceptable waste forms (concrete matrix).

Nearby facilities, where and when available, will be used to the extent practical to minimize the environmental impact of transport. During site operations, communications will be maintained to assess onsite and offsite interdependencies; for example, those between the AP1000 plant and offsite disposal facilities.

Figure 5-1 is a pictorial representation of the AP1000 waste management strategy. This strategy is integrated to take into account all matters that might have a bearing on the management of radwaste and spent fuel, including the following:

- Waste minimisation
- Avoidance of unnecessary introduction of waste into the environment
- Waste characterisation and segregation
- Collection and retention of data on the waste and waste packages
- Consideration of options in a BAT assessment
- Communications with interfacing facilities and stakeholders
- Assurance that steps in the management of waste are compatible
- Characterisation of risks and uncertainties

5.4 Proposed Waste Management Processes

The management process for the AP1000 waste streams is described in section 3.5 of the ER [Ref. 3] and in section 6 of the IWS [Ref. 18]. The specific management process for ILW is described in sections 3.5.7.2 and 3.5.8.2 and figure 3.5-13 (reproduced as Figure 5-2) of the ER and in section 6.7 of the IWS.

A BAT assessment has been carried out on the LLW & ILW treatment system which addresses the waste activities from the transportation point of the “Nuclear Island” through to dispatch to the final repository. The BAT assessment involved Aker Solutions, Different by Design (DBD), WEC, and included representatives from several utilities [Ref. 6]. The conclusion of the BAT assessment was to encapsulate ILW in a cementitious grout matrix.

The waste encapsulation will be carried out using a Mobile Encapsulation Unit (MEU) on a campaign basis. The MEU will be stored in the Radwaste Building when not in use and moved to the AP1000 Auxiliary Building Railcar Bay for the campaign.

The use of mobile systems for the processing functions permits the use of the latest technology and avoids the equipment obsolescence problems experienced with installed radwaste processing equipment. The most appropriate and efficient systems may be used as they become available.

Encapsulated waste packages (RWMD $3m^3$ drums and boxes) will be transported using a shielded overpack to an onsite ILW store, where they will be stored until a national ILW repository (ILWR[3]) becomes available.

5.5 Relevant Buildings and Plant

Spent ion-exchange resin and activated carbon will be temporally stored in spent resin tanks located in the Auxiliary Building ‘Spent Resin Tank Room 12373’. The tanks and supporting equipment are described in section 11.4 of the DCD [Ref. 16].

Spent filter cartridges are loaded into RWMD compliant $3m^3$ boxes within the ‘Waste Disposal Container Area 12374’ using the Filter Cask Portable Handling Device (FCPHD).

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3. The ILW repository and the GDF (as referred to by the RWMD) within this document refer to the same facility i.e., the final disposal facility for ILW.

Spent cartridges requiring analysis are temporally stored in the spent filter tubes at the West end of the Auxiliary Building Railcar Bay. The cartridge handling and storage equipment is described in section 11.4 of the DCD [Ref. 16].

The MEU will be deployed on a campaign basis in the railcar bay of the auxiliary building. When not in use it will be stored in the Radwaste Building. The MEU transfer route will be; out of the Radwaste Building via the East roller shutter door, travel outside and enter the Railcar Bay via the 'Truck Staging Area 50354'.

Encapsulated ILW packages will be stored within the onsite ILW store until a national ILWR becomes available. The ILW Store is described in section 2.3.6.2 of the ER [Ref. 3].

All activities relating to ILW i.e., storage or conditioning and loading into $3m^3$ containers, takes place on the seismically rated nuclear island. The MEU will be secured to the seismic raft during processing. All of the cranes involved in these transfers are suitably categorised as Seismic Category 1 or 2.

5.6 Facility, Organisation, and Management of Radioactive Waste

Chapter 26 of the PCSR [Ref. 17] provides an overview of the AP1000 radioactive waste management and justifies the measures proposed for the safe management of all types of radioactive waste that is generated throughout the lifetime of the plant. This Section also provides overviews of the AP1000 Gaseous Radwaste System (WGS), the Liquid Radwaste System (WLS) and the Solid Radwaste System (WSS).

More detailed information can be found in section 3 of the ER [Ref. 3] and in the IWS [Ref. 18] which summarises the radioactive waste management strategies to be used during construction, operation, and decommissioning and demonstrate that the chosen waste management processes are the best available technology (BAT).

The IWS provides a co-ordinated approach to waste management and stakeholder engagement, makes the most effective use of existing waste management facilities and provides value for money. In particular, the IWS demonstrates that the framework, for consideration of potential waste management options, transparently takes account of the full range of relevant health, safety, environmental, and security (including safeguards) principles and regulatory requirements. The IWS relates to all wastes and all materials that could become waste, radioactive and nonradioactive, arising from all stages of the site lifecycle including operational and decommissioning activities.

The Westinghouse Safety and Quality philosophy is outlined in chapter 3 of the LCSR [Ref. 28]. Any work carried out by Westinghouse on the AP1000 project will be in accordance with the Westinghouse Quality Management System (QMS) [Ref. 31]. The QMS has been developed taking into consideration external legislation and regulatory requirements and it will be reviewed periodically to maintain currency.

Westinghouse will implement its Safety Management System:

- Up to the end of Phase 2 of the GDA process,
- During subsequent plant construction and
- During the commissioning phase prior to product acceptance handover to the operating organisation's Licensee.

The safety case is currently owned by Westinghouse, the requesting party for Phase 1 of the GDA process. A key issue is that once the Design Acceptance Confirmation is received, the operating organisations that become Licensees will own the safety case and will be responsible for any changes and future reviews of that design, albeit with input from WEC where deemed appropriate by both parties.

Maintenance and management of safety throughout the life of the AP1000 nuclear plant will be the responsibility of the respective licensee that operates the plant. This will be done in accordance with regulatory guidelines

5.7 Interdependencies Among All Steps in Generation and Management of Radioactive Waste Management.

Aspects of the interdependencies between all steps in generation and management of radioactive waste have already been addressed in Section 4.2 of this report. This section describes how parts of the nuclear safety cases for the different systems of the AP1000 may cover, in whole or in part, the topics of concern to the AP1000 RWMC's. In the interests of ensuring interdependencies are properly taken into account, it is not appropriate to produce nuclear safety cases in isolation from RWMCs. Consequently, how interdependencies are taken into account will be made clear in each RWMC. The existing components will be reviewed, if necessary amended, and then referenced. In this aspect, the key component of the case will be a top-tier document explaining how the various components of the case fit together. Figure 4-1 illustrates the hierarchy of the currently produced suite of documents for the RWMC.

The IWS [Ref. 18] also provides information about these interdependencies. The IWS has been developed to assist in the identification of the strategic issues relating to waste management and to guide the development of waste management plans. One of the primary purposes of the IWS is to provide a coordinated approach to waste management and stakeholder engagement. Section 3.1 of the IWS outlines the key legislative and regulatory requirements that will be incorporated into site management procedures by AP1000 licensees including those related to waste management. Section 3.2 of the IWS describes some of the aspects to be considered by the licensee when defining roles, responsibilities and procedures within their waste management structure. Section 3.3 of the IWS outlines the waste management features to be addressed by licensee's Integrated Management System including control of waste management activities, the sharing and use of good practice and the management of interfaces with other sites. Section 4 of the IWS outlines how utility companies, the eventual AP1000 operators, have been involved in the development of the IWS. It also describes how future licensees will develop specific stakeholder IWS engagement processes to ensure a wide ranging and inclusive consultation on relevant issues. The process shall be flexible to allow engagement on any topics determined by the plant operator and should also allow alignment with other stake holder processes.

The MEU will be deployed in the Railcar Bay of the Auxiliary Building for the encapsulation campaign. The Railcar Bay has a number of other uses, including new fuel unloading and spent fuel loading. The ILW encapsulation campaign will be sequenced in with the other uses of the Railcar Bay, for example between fuel outages.

Other detailed interdependencies affecting specific equipment operations (e.g., Spent Resin Tank & Pumps) will be evaluated and sequenced where necessary at the specific site detail design stage. This will be covered in Operation and Maintenance Manuals and Mechanical Handling Diagrams etc.

5.8 How the Generation of Radioactive Waste is Minimised

Section 3.2 and 3.5.4 of the ER [Ref. 3], section 3.1.1 of the IWS [Ref. 18] and section 2.1.2 of the Long term Storage of ILW and Spent Fuel document [Ref. 33] outline ways in which the generation of radioactive waste is minimised at source in the AP1000. Ways in which the generation of ILW is minimised include:

- Selection of ion exchange media to give an optimum decontamination factor, which will minimise the number of ion exchange media changes required and reduce the waste volume.

- Flexibility in routing effluent through the different ion exchange beds to optimise resin uptake.

- Testing filter performance to ensure filters are only replaced when necessary.

Formulation trials to determine an optimum blend ratio producing the optimum number of waste packages.

5.9 How Radioactive Waste Is Adequately Controlled and Contained

ILW will be controlled and contained following the waste management procedures described in Section 5.4.

Details of how the ILW is adequately controlled and contained are found in Chapters 3, 11 and 26 of the PCSR [Ref. 17]. Additional detailed information is available in the Radwaste Arisings, Management and Disposal Document [Ref. 36].

Waste is physically contained within vessels and pipework. Information concerning the control and containment of ILW is found in sections 3, 4, and 5 of the DCD [Ref. 16].

Areas will be appropriately classified according to the radiation and contamination guidelines [Ref. 36].

5.10 How Safeguards and Security Issues Will Be Addressed

The Nuclear Directorate’s Office for Civil Nuclear Security (OCNS) is the security regulator for the UK’s civil nuclear industry. It is responsible for approving security arrangements within the industry and enforcing compliance. OCNS conducts its regulatory activities on behalf of the Secretary of State for Business, Enterprise, and Regulatory Reform under the authority of the Nuclear Industries Security Regulations 2003 (NISR 03) [Ref. 19].

The UK Safeguards Office (UKSO) oversees the application of nuclear safeguards in the UK to ensure that the UK complies with its international safeguards obligations. Nuclear safeguards are measures to verify that States comply with their international obligations not to use nuclear materials (plutonium, uranium, and thorium) for nuclear explosives. Global recognition of the need for such verification is reflected in the requirements of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) for the application of safeguards by the International Atomic Energy Agency (IAEA) [Ref. 19].

Safeguards and security issues will be addressed fully in the plant safety cases; for example, PCSR [Ref. 17], LCSR [Ref. 28] or individual plant safety cases.

The Licensee who will operate the specific AP1000 sites will have to comply with these regulations when preparing RWMC documentation.

5.11 How Radioactive Waste Meets Relevant Requirements to Enable Its Transport

The waste packages will be classified as ILW. Waste will be classified in accordance with EA definitions [Ref. 21].

All ILW is encapsulated, stored, transported, and disposed of in RWMD-approved containers.

During transport, each waste package will be placed in an overpack to provide radiation shielding and also to ensure the integrity of the waste during a road accident. The total weight of the waste package will be within appropriate limits for transport on UK roads when necessary.

Regulations for transport of radioactive waste in the UK are outlined by the radioactive material (road transport) regulation [Ref. 25]. These are supplemented by guidance issued from RWMD (Nirex) [Ref. 24]. Details of ILW transport to the national ILWR are outlined in subsection 3.5.9.2 of the ER [Ref. 3].

The RWMD GDA Disposability Assessment [Ref. 27] states that: “the proposals for the packaging of operational and decommissioning ILW have been judged to be compatible with RWMDs current plans for transport to and disposal of ILW in the Geological Disposal Facility (GDF).”

There are no outstanding fundamental issues related to the transport of the proposed GDA ILW packages.

5.12 Quality Assurance Arrangements

The WEC policy for Quality Assurance (QA) is described in Section 1.4.1 of the ER [Ref. 3], Section 1 of the PCSR [Ref. 17] and section 3 of the LCSR [Ref. 28]. The policy is implemented through the WEC Quality Management System (QMS) [Ref 31] which has been developed to comply with regulatory, industry, and customer quality requirements. The QMS applies to all activities that affect the quality of items and services supplied by Westinghouse.

For the GDA process, the QMS is supported by the Project Quality Plan for UK Generic Design Assessment [Ref 32]. This establishes the Project QA Plan and defines the QA objectives for the conduct of activities to be performed by WEC related to the GDA of the AP1000 and supporting licensing activities in the U.K.

The Project Quality Plan specifies the organisation and procedures used to control quality for the GDA process. Design control is a key aspect of this and all WEC licensing documents are subject to the Westinghouse configuration control process to ensure they reflect the AP1000 design and are quality assured.

Section 1.4.3 of the Environment Report [Ref. 3] outlines the ways in which Westinghouse will support the management systems of future AP1000 Licensee’s. This includes working with Licensees to support the production of a comprehensive Licensee quality management system insofar as the safety and environmental aspects of operation of the Westinghouse AP1000 design is concerned.

5.13 Information and Records Management Arrangements

Future AP1000 Licensees will develop and maintain a document management system that ensures appropriate information and records are retained. Section 1.4.3 of the ER [Ref. 3] outlines the ways in which Westinghouse will support the management systems of future AP1000 Licensee's including the transfer of AP1000 information into Licensee's document management system. Section 1.4.3.3 provides further details of the ways in which Westinghouse will support this knowledge transfer and highlights how such arrangements are already in place during the GDA process through the involvement of the utilities in the safety and environmental document specification and review process.

Aspects of the Waste Management Organisation that will be developed and implemented by future utility operators of an AP1000 are outlined in sections 3.2 and 3.3 of the IWS [Ref. 18]. Management of information and records will be a key feature of the site integrated management system and will underpin the effectiveness of:

- Monitoring and recording the environmental performance of the plant
- Sharing and use of good practice across waste-streams, projects on the site and with other sites
- Identification of research and technology requirements relating to waste management
- Identification of competence and skills requirements relating to waste management

Future AP1000 licensees are also likely to join and to contribute to the Pressurized Water Reactor Owners Group, formerly the Westinghouse Owners Group, which provides a focus for information, services, and development programs from which Owners and Licensees of AP1000 plants can benefit. The group is coordinated centrally by WEC.

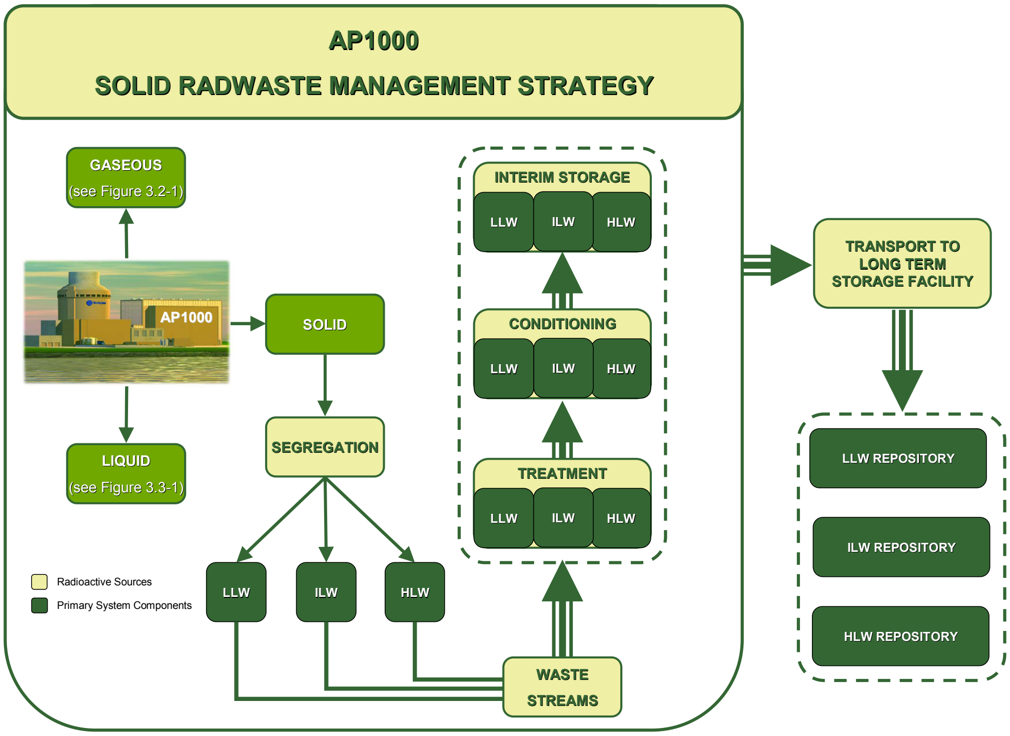

Figure 5-1. AP1000 Solid Radwaste Management Strategy

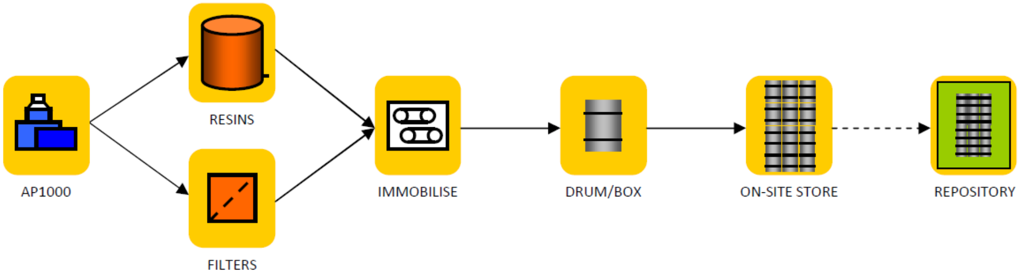

Figure 5-2. Solid ILW Treatment and Disposal

6. RADIOACTIVE WASTE MANAGEMENT STRATEGY

6.1 Subsidiary or Secondary Waste Streams Produced

Spent IX resin is delivered into the MEU entrained in transport water, most of which will be returned to the AP1000 waste water system for treatment. The MEU will incorporate a water decant system that is used in conjunction with a mass flow measurement, density measurement, level measurement and weight measurement to determine the water content in the drum. Measurements made are recorded by the waste package tracking system and form part of the QA record for a particular drum.

Encapsulated ILW packages will be swabbed clean (as required) using specifically selected absorbent materials. The MEU will also be capable of decontaminating the packages and the cell interior using demineralised water. The dry swabbing material will be transferred to the radwaste building or encapsulated dependent on activity level. The wash-down water will be returned to the AP1000 waste water system for treatment.

The generation of effluents arising from ILW Store operations will be assessed throughout the design period and reduced/eliminated as far as possible. However it is considered that, as a minimum, ventilation stack monitoring systems and associated upstream monitoring systems for ventilation systems will be required. Liquid effluent requirements e.g., addressing any need to deal with in-vault condensation arisings, will be similarly assessed. Should it be determined that decontamination processes are required within the store then ‘dry’ methods (such as swabbing) will be utilised thus eliminating liquid effluents.

Spent HVAC filters are expected to be classified as LLW and transferred to the radwaste building for treatment. The specific management process for LLW is described in sections 3.5.7.1 and 3.5.8.1 of the ER [Ref. 3].

6.2 Identification of Ultimate Destinations for the Wastes, Be It Disposal or Long-Term Storage

An ILW store will be provided on the AP1000 site for interim storage of ILW packages before their ultimate transfer to the national ILWR when it becomes available.

The ultimate destination of all the ILW packages is the national ILWR for disposal.

Information is in Section 6 of the IWS [Ref. 18], which outlines the final disposal routes, and the NDA disposability assessment [Ref. 27], which concludes that: “the proposals for the packaging of operational and decommissioning ILW have been judged compatible with RWMDs current plans for transport and disposal of ILW.”

Additional information can also be found in subsection 3.5.9.2 of the ER [Ref. 3].

6.3 Options and Processes Considered to Convert Raw Waste into a Product Suitable for Long-Term Storage

The options and processes considered to convert the raw waste into a product suitable for long-term storage were considered in full during a BAT assessment [Ref. 6]. The BAT assessment captures the current understanding of the best available options at this time. The licensee may want to reassess these options if alternative techniques become available in the future.

The BAT assessment concluded that immobilisation of ILW within a cementitious grout in a RWMD-approved waste container is considered the best practice for conditioning and disposal of ILW waste.

A summary of the BAT assessment is in subsection 3.5.5 of the ER [Ref. 3].

The NDA disposability assessment [Ref. 27] also states that: "the proposals for the packaging of operational and decommissioning ILW have been judged to be compatible with RWMDs current plans for transport to and disposal of ILW in the GDF."

6.4 Reasons and Assumptions Used to Reject Options

The BAT assessment [Ref. 6] outlines the reasons and assumptions used to reject options for the preconditioning and disposal of ILW.

These reasons and assumptions have been outlined in subsection 3.5.5 of the ER [Ref. 3].

6.5 Reasons, Assumptions, Uncertainties, Calculations, and Conclusions for Selecting Preferred Option(s)

The BAT assessment [Ref. 6] outlines the reasons, assumptions, uncertainties, and conclusions used to select the preferred options for the preconditioning and disposal of ILW.

These reasons and assumptions are outlined in subsection 3.5.5 of the ER [Ref. 3].

6.6 How Preferred Option Is Consistent with the Integrated Waste Strategy

The waste management strategy for ILW and decommissioning waste is in Sections 6.7 & 6.9 of the IWS [Ref. 18]. The BAT assessment was governed by the management strategy. Thus the proposed waste management process for ILW, detailed in Section 5.4 is consistent with the strategy.

6.7 How Preferred Option Is Consistent with Existing and Reasonably Foreseeable Provisions for Transport, Storage, and Disposal

The BAT assessment [Ref. 6] outlines how the preferred option is consistent with existing and reasonable foreseeable provisions for transport, storage, and disposal of ILW.

This information is detailed within subsection 3.5.9 of the ER [Ref. 3].

The preferred option is the use of a cementitious grout formulation to immobilise the ILW in RWMD-approved waste containers. Transport vehicles suitable to contain waste package with shielding and to dissipate the weight on the UK roads are in line with regulations [Ref. 25]. These regulations have been supplemented by guidance from the RWMD (Nirex) [Ref. 24].

The use of mobile systems for ILW processing permits the use of the latest technology and avoids the equipment obsolescence problems experienced with permanently installed radwaste processing equipment. The most appropriate and efficient systems may be used as they become available. It is the intention that the BAT assessment be revisited should the regulations evolve or more suitable options arise.

6.8 Details of Stakeholder or Public Consultation

This RWMC evidence report forms part of the Westinghouse GDA submission which has gone to stakeholder and public consultation.

AP1000 plant operators will develop specific stakeholder IWS engagement processes. The processes will be designed to ensure a wide ranging and inclusive consultation on relevant issues throughout the operating life of the plant.

Further details of stakeholder engagement are described in Section 4.7 of the IWS [Ref. 18].

6.9 Use of and Implications for, Existing Waste Disposal Routes if Preferred Option Is Selected

The selection of the proposed waste disposal route, as outlined in Section 5.4, is not expected to have any implications for existing waste disposal routes as stated in the NDA Disposability Assessment [Ref. 27] which concluded that:

"No new issues arise that challenge the fundamental disposability of the wastes and spent fuel expected to arise from operation of such a reactor."

The preferred option is the use of a cementitious grout formulation to immobilise the ILW in RWMD-approved waste containers. The ILW packages will then be stored in an onsite ILW store provided for interim storage of ILW waste packages until an ILWR becomes available.

Additional research and development is required to enable a final ILWR to be constructed. Information on the NDA RWMDs proposed research and development is found in [Ref. 9].

7. WASTE MINIMISATION, CHARACTERISATION, AND SEGREGATION

Waste minimisation, characterisation, and segregation are central to both establishing and updating a radioactive waste inventory and optimising waste management in line with the waste management hierarchy. Opportunities for waste minimisation, characterisation, and segregation will be considered in all stages of waste management, including design, construction, operation, decommissioning, storage, and disposal.

The regulators have published guidance on waste minimisation, characterisation, and segregation [Ref. 2] that should be read in conjunction with this Section.

7.1 Description of Techniques Adopted to Prevent or Minimise Arisings

Minimisation of waste is fundamental good practice in radioactive waste management. It has been considered during the design of facilities and applied during all of the basic steps. Effective methods of minimising the accumulation of radioactive waste include the clearance of waste that is exempt from regulatory control and the reuse or recycling of radioactive material.

Minimisation is an important initial step in waste management, and AP1000 operational procedures will seek to design, construct, operate, and decommission the plant in such a manner that both the waste volume and radioactivity are minimised.

On the AP1000 nuclear site, this will be achieved by such activities as the following:

- Optimum operation of the reactor in terms of power generation per tonne of fuel, minimise fuel defects, and hence, minimise the activity of primary cooling water circuit, which in turn, minimises volumes of spent IX resin

- Good housekeeping; for example, minimising the amount of material brought into containment

- Selection of IX media to give optimum decontamination factor, which will minimise the number of IX media changes required and reduce the waste volume

- Formulation trials to determine optimum blend ratio producing the optimum number of waste packages

- Operating procedures

Ways in which the generation of ILW is minimised are outlined in Section 5.8 of this report and described in detail in Section 3.2 and 3.5.4 of the ER [Ref. 3] and section and Section 2.1.2 of the Long Term Storage of ILW and Spent Fuel document [Ref. 33].

7.2 Details of Methods Used for Segregation and Characterisation of Wastes and Practicable Steps Taken to Avoid Dilution

7.2.1 Segregation

Segregation of radioactive waste involves accumulating together those materials with similar characteristics and avoiding mixing wastes with different characteristics.

Segregation can be defined as: "An activity where waste or materials (radioactive and exempt) are separated or are kept separate according to radiological, chemical, and/or physical properties which will facilitate waste handling and/or processing" [Ref. 4].

Segregation of ILW on an AP1000 nuclear site will take place in the following ways:

- IX activity is monitored and spent resin is transferred to spent resin tanks once the activity breakthrough level has been reached. Only ILW resins will be sent to spent resin tanks [Ref. 36].
- ILW filters will be placed in an RWMD-approved box before encapsulation in a cementitious grout. Only ILW filters will be placed in the box [Ref. 36].
- This segregation is an operationally controlled procedure which will occur in the auxiliary building.
- Both (IX resin and filters), once encapsulated, will be transferred to the ILW store where the drums/boxes will be numbered, characterised, labeled, and stored in a known/recorded location within the store [Ref. 36].

Information on segregation of ILW is included in Section 3.5 of the ER [Ref. 3]. Further guidance on the segregation of radioactive waste can be obtained from the joint guidance published by the regulators [Ref. 2].

7.2.2 Characterisation

Characterisation of radioactive waste involves determining its physical, chemical, biological, and radiological properties. It can be carried out for recordkeeping, for moving waste between steps, and for determining the best method of managing waste [Ref. 2].

The activity level of the ILW will be measured prior to treatment through probes in the filter handling flask and spent resin tanks. The MEU will be equipped with mass flow measurement, density measurement, level measurement and weight measurement to determine the content of the waste package. Measurements made will be recorded by the waste package tracking system and form part of the QA record for the particular package.

Activated carbon will be encapsulated with the spent IX resin. However, if the activated carbon is not classified as ILW, the facility will exist to remove the activated carbon from the IX vessel separately and for it to be disposed of as LLW.

Prior to the immobilised ILW entering the ILW store, it will be monitored using an High Resolution Gamma Spectroscope (HRGS) to be "fingerprinted." Fingerprint analysis is the common usage name for the practice of determining the range of activities and isotopes present in a consistent waste stream whereby it is possible to build up a fingerprint of the isotopes from measurements. This then allows one isotope (for example, cobalt-60) to be measured, and the presence and general proportions of other isotopes can be inferred from the amount/activity of cobalt 60 that is present. The procedure is described in the "Radioactive Waste Arisings, Management and Disposal" [Ref. 36].

This allows each of the waste packages entering the ILW store to be fully characterised.

Further guidance on the characterisation of radioactive waste can be obtained from the joint guidance published by the regulators [Ref. 2].

7.2.3 Dilution Avoidance

There will be no dilution of ILW streams by mixing them with LLW streams. This will be controlled via operational procedures.

7.3 Evidence that Waste Streams Can be Characterised to Level Necessary to Ensure Compliance with Specification for Waste Packaging

Evidence that the ILW expected to arise from the operation of an AP1000 can be characterised to the level necessary to ensure compliance with specification for waste packaging comes from the conclusions of the GDA Disposability Assessment undertaken by the RWMD [Ref. 27]. The assessment was based on information supplied by Westinghouse on the nature of operational and decommissioning ILW, and spent fuel, and proposals for the packaging of these wastes. The RWMD assessed the implications of the disposal of the proposed ILW and spent fuel disposal packages against the waste package standards and specifications developed by RWMD and the supporting safety assessments for a GDF.

The RWMD concluded that "ILW and spent fuel from operation and decommissioning of an AP1000 should be compatible with plans for transport and geological disposal of higher activity wastes and spent fuel."

Work will be carried out during site specific design to refine the assumed radionuclide inventories of the higher activity wastes and spent fuel and to develop more detailed proposals for the packaging of the wastes and spent fuel and a better understanding of the expected performance of the waste packages. These more specific and detailed proposals will be assessed by the RWMD through the established Letter of Compliance (LoC) process for assessment of waste packaging proposals. See appendix 3 for the expected timetable of the LoC process in relation to other plant activities.

8. CONDITIONING AND DISPOSABILITY

8.1 How Passive Safety Will Be Achieved

One of the ND's fundamental expectations is that, so far as is reasonably practicable, radioactive materials and radioactive waste should be stored according to the principles of passive safety.

Passive safe storage of radioactive materials and radioactive waste is most appropriately achieved by providing multiple physical barriers to the release of radioactivity to the environment. The physical barriers include the form of the waste or material itself, the material used for encapsulation, the waste container, and the storage building or structure, each of which should be designed to provide effective containment and prevent leakage.

Passive safety is achieved during the handling, conditioning and storage of the ILW by:

- Specific safety design features of the ILW auxiliary building systems such as secondary containment around spent resin tanks. All of the safety features of the applicable systems are outlined throughout section 11 of the European DCD [Ref. 16].

- Safety and containment features of unconditioned ILW transfer equipment such as double skinned resin delivery pipe and dry break flanges. The MEU will be seismically secured to the floor of the (seismically qualified) railcar bay.

- Ensuring the railcar bay crane and the ILW store crane are of a suitable integrity level and equipped with an interface grapple suitable for engagement with twistlock type features of a standard waste package of RWMD approved design.

- Interlocks on doors accessing the MEU and the ILW store vault, thus ensuring there is no direct shine path.

- Placing waste packages within an overpack during transportation to provide radiation shielding and also to ensure integrity of the waste during a road accident.

- Providing multiple physical barriers to mitigate the release of radioactivity from packages stored in the ILW store. The package is immobilised in a cementitious grout, contained in a RWMC approved container, surrounded by other encapsulated packages, within a fully enclosed shielded vault.

For further information, see chapter 26 of the PCSR [Ref. 17], section 3.5 of the ER [Ref. 3] and section 11.4 of the DCD [Ref. 16].

8.2 Evidence that Waste Package Produced Will Be Consistent with Existing and Reasonably Foreseeable Provisions for Transport, Storage, and Disposal

Evidence that the proposed ILW packages will be consistent with existing and reasonably foreseeable provisions for transport, storage and disposal comes from the conclusions of the GDA Disposability Assessment undertaken by the RWMD [Ref. 27] as described in Section 7.3 of this evidence report.

The proposed ILW packages will be endorsed through the LoC process and wastes will be packaged, stored and disposed of in accordance with the Waste Product Specification (WPrS) developed through that process.

Since the waste packages will be in RWMD-approved containers and will have been immobilised, it is expected that the waste packages will comply with most aspects of the existing standards and specifications, and will meet the Conditions for Acceptance (CfA) for the national ILW repository.

Regulations for transport of radioactive waste in the UK are outlined by the Radioactive Material (road transport) Regulations [Ref. 25]. These regulations include transportation from the encapsulation plant to the offsite storage facility. These are supplemented by guidance issued from RWMD (Nirex) [Ref. 24].

Details of the transportation on UK roads and highways and disposal of ILW are found in subsection 3.5.9 of the ER [Ref. 3].

8.3 Identification of any Significant Issues that may Challenge Disposability

The AP1000 GDA Disposability Assessment undertaken by the RWMD [Ref. 27] concluded that:

> "Compared with legacy wastes and existing spent fuel, no new issues arise that challenge the fundamental disposability of the wastes and spent fuel expected to arise from operation of such a reactor".

The RWMD will assess the more specific and detailed ILW disposal proposals developed during site specific detailed design as part of the established LoC process for assessment of waste packaging proposals.

8.4 Intended Specification for Waste Package

It is intended that the ILW will be immobilised in RWMD-approved boxes/drums. The ILW containers will be compliant with the generic Waste Package Specification (WPS) [Ref. 5] produced by the RWMD (Nirex). The waste will be packaged in accordance with a WPrS to be developed through the LoC process.

Overall, the GDA proposals for the packaging of operational and decommissioning ILW have been judged to be potentially viable. While further development needs have been identified [Ref. 27], including ultimately the need to demonstrate the expected performance of the packages, these would represent requirements for future assessment under the LoC process.

As a result, it is currently expected that the ILW packages can be developed to meet the CfA for the proposed ILWR.

8.5 How Inventory of Individual Packages Will Be Controlled and Measured

The inventory of the individual waste packages will be determined and controlled as described in the following subsections.

8.5.1 Ion Exchange Resin/Activated Carbon

All ILW IX resin and activated carbon will be transferred to the spent resin tanks (2 off) in the auxiliary building. The activities and volume of the spent IX resin and activated carbon that is transferred to the respective storage tanks in the auxiliary building will be known and recorded, along with their origin location, type of resin, etc. Therefore, the contents of the spent resin tanks and, hence the waste that is transferred into each drum, are known.

The activity of the IX resin beds is monitored and spent resin is transferred to the tanks once the activity breakthrough level has been reached. This level will be set by the licensee during specific site design and trials to ensure the limits of the package activity are not exceeded.

The spent resin tanks are equipped with mixing eductors, resin dewatering, air sparging, and complete draining capabilities [Ref. 16]. The tanks are fitted with this equipment to produce a homogeneous mixing of spent IX resin and activated carbon. The tanks will be fitted with level instruments.

Formulation trials for the cementitious grout in which the ILW spent resin/activated carbon will be immobilised will have determined the bounding formulation of the cement and how much of it to add to each drum. Thus, the entire contents of each drum will be known and recorded.

The amount of resin transferred from the spent resin tanks into the drum will be controlled via an automated transfer system, using a load cell for the drum plus contents, a flow meter, and a level probe on the drum. The facility will exist to return any excess motive water back to the waste water system for treatment [Ref. 3] and [Ref. 36].

This will be compliant with the parameters set by the formulation trials to achieve the optimum waste packages that comply with regulations. This same automated system will control the amount of cement and also capping grout that will be added to each waste package. As a result of this and the homogeneous mixing within the spent resin tanks, all waste packages will be similar and repeatable in terms of activity levels and weight.

Each waste package will have an HRGS fingerprint analysis performed as it enters the ILW store [Ref. 36] to assay the activity.

8.5.2 Waste Filters

Using AP1000 equipment and procedures, the ILW filters will be placed into an approved RWMD box, located in an appropriately shielded room within the auxiliary building. The filter cartridge activity will be measured and recorded during the transfer to the box. This will be achieved using a monitor probe located within the Filter Cask Portable Handling Device (FCPHD). For further detail see section 11.4.2.3.2 of the DCD [Ref. 16] and section 3.4.4.6 of the Radwaste Arisings, Management and Disposal Document [Ref. 36].

If required a sample of the filter media can be obtained through a port in the FCPHD for further analysis. The spent cartridge can be temporarily stored in one of nine storage tubes located in the auxiliary building until the analysis results are available.

The filters will be located at various positions within the plant. Thus, to keep an individual waste package inventory for the boxes, all types of filters (including their activity) will be recorded. This record of inventory will then be kept with the waste package during its storage within the ILW store and eventual transport and storage in the national ILWR.

The optimum number of filters that can be added to the RWMD-approved box will be determined to ensure that the maximum limit for weight, volume, and activity complies with the waste package acceptance criteria. Through simulation trials and initial operational data the frequency of replacement of the filters can be determined to ensure that the activity levels are within acceptable limits.

This procedure will ensure that the contents of all the boxes are known and recorded.

Each waste package will have an HRGS fingerprint analysis performed as it enters the ILW store [Ref. 36] to assay the activity [Ref. 3].

8.6 Demonstration that Proposed Packaging and Conditioning Strategy Uses BPM/BAT to Minimise Long-Term Environmental Impact and Ensure Associated Doses Are ALARP

At present, Westinghouse is planning to use a conditioning strategy that is the currently approved process at other UK nuclear installations for the treatment of ILW (waste resins and sludges). This was selected by the BAT assessment that was carried out for the solid ILW waste disposal strategy [Ref. 6].

This BAT assessment concluded that currently the BPM for solid ILW management should be encapsulation in cement, stored, and ultimately disposed of to the national repository.

The use of mobile systems for the processing functions permits the use of the latest technology and avoids the equipment obsolescence problems experienced with permanently installed radwaste processing equipment. The most appropriate BAT and efficient systems may be used as they become available.

For further information, refer to the original BAT assessment [Ref. 6]; the findings of which are detailed in subsection 3.5.5 of the ER [Ref. 3].

The proposed packaging and conditioning strategy will use an RWMD-approved waste container [Ref. 36]. Appropriate shielding calculations have been performed for the MEU, overpack and ILW store [Ref. 36]. These measures will be put in place during the packaging, conditioning and handling operations to ensure exposure to the operators and the public is ALARP.

8.7 Demonstration that Proposed Strategy Will Not Lead to Significant Increases in the Possibility of a Neutron Chain Reaction in a Disposal Facility

A nuclear criticality accident occurs from operations that involve fissile material and results in a potentially lethal release of radiation. This is not applicable for the type of ILW produced from the AP1000.

8.8 Assessment of Long-Term Performance and Degradation of Waste Containers

All ILW will be placed in RWMD-approved waste containers; spent IX resin/activated carbon in drums and ILW filters in boxes. These wastes will then be immobilised in a cementitious grout using an approved formulation to ensure the optimum waste package is produced. The containers will be constructed from stainless steel to aid the corrosion resistance.

The EA has performed a review of the longevity of intermediate level radioactive waste packages for geological disposal [Ref. 7] This report discusses the main technical issues associated with maintaining package integrity over long timescales.

The main conclusions from this review were that many of the technical issues relate to the threat posed by packages failing as a result of progressive aging or rapid deterioration. The associated risks and impacts include those relating to a loss in containment and those associated with the requirement to rework any failed packages.

In the absence of aggressive chemicals, and under suitably controlled ambient conditions, a 500-litre drum with a typical 2 mm thickness would be expected to take around 10,000 years

[Ref. 7] to corrode through. The RWMD $3m^3$ drum/boxes will be of a similar construction to that of the 500-litre drum, and therefore, it is expected to take a similar length of time to corrode through.

There is a critical thickness of corrosion after which the container would not function safely in accordance with its design specification. Therefore, the actual lifetime is likely to be less than 10,000 years. The RWMD (Nirex) has stated that this critical minimum thickness for handling is thought be about 0.3 mm. Therefore, it is extremely unlikely that a typical container will be corroded through by general corrosion during the care and maintenance phase, provided operating conditions are controlled.

Chlorides can break down the ‘passive film’ on the steel surface and hence affect corrosion of the package. Restricting chlorides from coming into contact with stainless steel containers is a key issue throughout the package lifecycle; therefore, surface chloride contamination will be kept below 1 μgcm^{-2} in order to achieve the target level for interim storage.

It is noted that corrosion can only proceed if water is present on the surface of the metal. The temperature of the environment will affect its relative humidity (hence water content). Temperatures will be maintained to ensure a storage environment with a maximum relative humidity of 80%.

The most frequently encountered corrosion problem of stainless steel items is the presence of embedded iron and loose iron particles. These rapidly rust and initiate corrosion due to the formation of crevices containing acidic chloride solutions. This will be avoided by ensuring carbon steel handling equipment does not come in contact with the waste containers at any time in their life cycle.

Additional information is in the “Radioactive Waste Arisings, Management and Disposal” [Ref. 36].

Further development on the detailed design of the ILW store will be undertaken at the specific site stage. For the GDA, details of the ILW store heating, ventilation, and air conditioning (HVAC) system are found in [Ref. 36].

The LoC process, carried out during the specific site stage will assess the performance of the package for its intended lifecycle. Information on the NDA RWMD proposed research and development is contained in [Ref. 9].

The stored packages will be routinely inspected for corrosion and damage; any non-conforming packages will be overpacked as described in Section 8.15. The stored package monitoring strategy [Ref. 29] will be developed during the specific site design stage by the licensee.

8.9 Identification of Any Potential Package Failure Mechanisms

A failed or non-conforming ILW package could arise from:

- Overfill of a package during encapsulation, causing spillage and contamination to the outer surface.
- Non-setting cement, resulting in mobile waste.
- Malfunction during lidding, causing and unsealed package.

- Corrosion/damage to the package, resulting in a containment failure.

The ILW waste packages will be subject to quality assurance checks during conditioning, such as the Dartometer test to confirm the cement has set and externally swabbed to confirm that the waste package is free from contamination and visual inspection [Ref. 36].

The ILW packages will also be visually inspected as they are imported into the ILW store. Section 8.8 describes the performance and degradation of packages including the routine inspection of stored packages.

A preliminary safety statement [Ref. 22], HAZOP 0 safety study [Ref. 23], and HAZOP 1 safety study [Ref. 26] have been completed, during which potential package failure mechanisms were addressed. The proposed GDA ILW designs address many of these issues; others are carried through to detailed design.

8.10 Evaluation of Any Reactions that May Take Place Between the Waste and the Conditioning Matrix

The materials most commonly used to encapsulate UK ILW are hydraulic blends of Ordinary Portland Cement, with either blast furnace slag, or pulverised fuel ash. The exact composition of the conditioning matrix will be determined during the formulation trials.

Certain waste materials may react adversely toward the cement mineralogy and, in some cases, also toward the container and other components of the waste. For example, wastes that contain calcium, magnesium, aluminium, and iron in suitable chemical and physical forms have the potential to change the assumed cement formulation [Ref. 7]. However since these metals are not present in the appropriate form in the spent IX resin/activated carbon, or in the ILW filters, then it is not envisaged that any of these will cause any reactions with the conditioning matrix.

However, it is known that organic ion exchange resin can expand over time in an alkaline environment (i.e., cement) and could cause the cementitious conditioning matrix to crack. This could cause failure of a waste package in terms of activity levels and structural integrity for storage. This effect can be negated by limiting the amount of resin added to the blend or addition of caustic to the organic IX resin before encapsulation. This will accelerate the expansion of the resin so that it is fully expanded before grout addition. This will allow a greater proportion of IX resin to be placed in each drum. The use of this procedure will be determined during formulation trials.

It is reported [Ref. 8] that development trials for encapsulation of organic resins at greater resin/cement ratios have been successful, albeit some requiring pretreatment of the resin using a sodium hydroxide solution.

This information has been outlined in Section 3.5 of the ER [Ref. 3]. Although it is expected that no reactions will occur that will detrimentally affect the integrity of the waste form, this subject requires further research. This will be assessed by the licensee during the specific site design stage, as part of the LoC process for the waste packages.

For further information refer to the “Radioactive Waste Arisings, Management and Disposal” [Ref. 36], and RWMD (Nirex) report N093, Sizewell B, “Waste Stream 3S12 CVCS Resin and Spent Resins” (ILW) [Ref. 10].

8.11 Evaluation of Long-Term Performance of Waste Form

RWMD (Nirex) studies indicate that waste form grout mineralogy, after 2 years, is little different from that of 15-year-old samples. This gives some confidence that phase evolution will be limited in the short term [Ref. 7].

Extrapolating such results over a timeframe of several centuries would, in isolation, not be credible because it cannot be guaranteed that all processes of interest have been accounted for [Ref. 7].

There appears to be less understanding of other effects of ageing on the long-term chemical and physical properties of cement that influence its performance as an engineered barrier. RWMD (Nirex) has investigated how cement-ageing processes affect the properties that determine its fire and impact performance. However, to date RWMD (Nirex) has not outlined any understanding of how cement ageing influences post-closure performance (for example, the effects of ageing on the ability of cementitious waste forms to retain radionuclides) although relevant work has been done, both in the United Kingdom and internationally [Ref. 7].

For further information, refer to the EA's review of the longevity of intermediate level radioactive waste packages for geological disposal [Ref. 7].

The waste form proposed has been assessed to be the current BAT [Ref. 6].

Additional research is required in this area. This will be assessed by the licensee during the specific site design stage, as part of the LoC process for the waste packages.

8.12 Assessment of Potential for Gas Generation from Wastes in Long-Term

Gases may be released over time due to the natural breakdown and degradation of the organic IX resin (e.g., hydrogen, carbon dioxide, and methane). Some of this gas could potentially be radioactive. The RWMD waste containers are suitably rated to allow the evolution of gases during storage, and the ILW store will have a suitably rated HVAC system to prevent the buildup of gases within the ILW store.

The EA's Nuclear Waste Assessment Team (NWAT) commissioned Quintessa to review the RWMD (Nirex)/NDA work relating to gas evolution and migration in the context of disposing of higher activity radioactive waste in a deep geological repository [Ref. 12].

The review from NWAT concluded that the RWMD (Nirex) has taken into account most of the processes likely to generate gas and the issues that may affect long-term safety. The report identifies key issues that need to be addressed, including the challenge of modelling gas and its effects.

Further information on gas generation is found in the following:

- Specification for SMOGG Version 5.0: "A Simplified Model of Gas Generation from Radioactive Wastes" [Ref. 13]
- "Comparison of gas generation and gas transfer analyses for Nirex, Nagra and Andra ILW, HLW and SF Repository Concepts" [Ref. 14]

Additional research is required in relation to gas migration within the final ILWR. This will be assessed by the licensee during the specific site design stage, as part of the LoC process for the waste packages. Information on the NDA RWMDs proposed research and development is found in [Ref. 9].

8.13 Consideration of Impact of Toxic Materials as a Result of Release from a Disposal Facility and Environmental Impacts that Might Arise During, or as a Result of, Operations

The proposed waste management processes for the handling, packaging, transportation and storage of ILW, as outlined in Section 5.4 are based on the principle of containment. Successful containment of the ILW will mean that potentially harmful radiotoxic, toxic and chemical releases are avoided. Therefore, in order to minimise the risk of a loss of containment, multiple levels of safety (Section 8.1) have been designed into the ILW handling systems, equipment and ILW store and will be integral to the design of the ILWR.

A list of AP1000 internal hazards can be found in section 11 of the PCSR [Ref. 17]. Combinations of these internal hazards, and the potential for consequential hazards to arise, have been assessed, where these are realistic. This section also specifies the design requirements of plant systems, structures and components against internal hazards, such that appropriately safe operation can be maintained. How these requirements have been built into the design of the plant systems, structures and components is described in detail in the DCD [Ref. 16].

This RWMC will demonstrate the proposed measures for avoiding a loss of containment. The mechanisms for loss of containment or the environmental impact of a loss of containment, have not been addressed at this stage.

Prior to conditioning and packaging the ILW, containment is provided by spent resin tanks, filter storage tubes and shielded enclosures. During the conditioning of the ILW, containment is provided by the shielded MEU. Once the ILW has been conditioned and packaged, containment is provided by the cementitious grout matrix and the sealed package. During on-site and off-site transportation, packages will be placed in an overpack to provide radiation shielding and also to ensure the integrity of the waste during a road accident. The site interim ILW store provides corrosion mitigation and additional shielding for the packages and the environment around the packages will be continually monitored so any loss of containment will be detected and appropriate measures taken (see section 3.5.8.2 of the ER [Ref. 3]).

See Section 8.12 for a description of the potential for gas generation from ILW packages throughout their lifecycle. There is potential for traces of toxic species, further research is required to assess if the concentration levels are of concern. The LoC process will address this further during specific site detail design.

8.14 An Assessment of the Potential Impact from Any Detrimental Effects due to Chemical Species That May Be Present in the Wastes or Might Reasonably Be Expected to Form

As outlined in Section 8.5, the contents of each waste package will be known. It is not expected that any chemical species, additional to those in spent IX resin, activated carbon, ILW filter cartridges, and cement formulation, will be present in any of the ILW waste packages produced onsite.

The failure mechanisms outlined in Section 8.9 are not expected to produce any additional chemical species. None of the reactions outlined in Section 8.10 are expected to occur, and therefore, it is not expected that any chemical species will form. Decay over long term storage may produce gases as outlined in Section 8.12 due to the natural breakdown of organic material. The LoC process will assess the possible production of other chemical species from IX degradation.

Sections 8.8 and 8.11 outline the evaluation of the long-term performance of the waste containers and the waste form respectively. These Sections are based on currently available information in terms of UK best practice and the nature of the waste streams.

The NDA disposability assessment [Ref. 27] states that: “the proposals for the packaging of operational and decommissioning ILW have been judged to be compatible with RWMDs current plans for transport to and disposal of ILW in the GDF.”

8.15 How Conditioned Waste that Does Not Meet Specifications Will Be Managed

ILW packages that do not meet specifications due to external contamination are swabbed clean (as described in Section 6.1) within the MEU.

ILW packages that do not meet specifications due to mechanical defects (Section 8.9) will be placed (overpacked) into a secondary containment vessel (SCV) as described in section 3.5.8.2 of the ER [Ref. 3]. An area will be assigned within the ILW store where these can be stored as described in the “Radioactive Waste Arisings, Management and Disposal” [Ref. 36].

Overpacking of failed ILW packages was chosen for the purpose of GDA, ensuring operator dose uptake is ALARP. Currently no area or equipment exists to conduct structural repair/remedial works on a non-conforming or failed waste package. This option may be developed by the Licensee during site specific detail design.

8.16 Arrangements for Quality Assurance and Records

Arrangements for QA and records are a matter for the licensee of the specific site and the regulator. The licensee is obliged to employ suitably qualified and trained staff in the operation of the AP1000. They will be responsible for QA activities, including keeping records for the waste inventory that is passed to the ILW store and ILWR.

Quality assurance on the waste packages will be carried out by, but is not limited to the following:

- Records of what waste (IX resin and filters) has been put into each waste container
- Use of approved RWMD waste containers
- Use of approved grout formulation method
- Dartometer test before and after capping grout is added to waste package
- HRGS analysis of each waste package
- Individual number/location identifier for each waste package within the store

These are outlined throughout Section 3.5 of the ER [Ref. 3], and strategic level information on QA and records are found in Sections 3.2 and 3.3 of the IWS [Ref. 18].

Records will accompany the waste from origin to storage and will remain with the waste packages until their eventual transport to the national geological repository.

The regulators have released guidance on managing information relating to radioactive waste in the United Kingdom [Ref. 11].

The QA arrangements that are in place for the GDA process and the ways in which Westinghouse will support the production of comprehensive licensee quality management systems are outlined in Section 5.12. Also see section 10 of this report for further details on record keeping.

8.17 How Developments in Disposal Facility Requirements Will Be Taken Into Account

As described in Section 8.8, work will be carried out during site specific detailed design to establish the final design of the ILW disposal packages. This process will be driven by confirmation of the WPS that will be accepted by the future ILWR. Assessment of the final ILW disposal WPS against the requirements of the ILW disposal facility will be part of the RWMD LoC process.

9. STORAGE OF RADIOACTIVE WASTE

9.1 Storage Capacity Requirements

The onsite ILW store will accommodate the expected number of waste packages from AP1000 operations. This has been determined by the radwaste mass balance [Ref. 15]. The volumes of waste determined by the mass balance have been based on the waste arisings outlined in the Section 3 of the ER [Ref. 3]. The expected ILW, arising from 60yrs operation of an AP1000 is: 561m^3 of IX resin, 41m^3 of activated carbon and 15m^3 of spent filters. This equates to 1116 RMWD 3m^3 packages, requiring a combined storage volume of 4044m^3

Currently, the expected number of waste packages is based on the operational period of 60 years for the AP1000. Until a long term ILWR becomes available, it is proposed to build an interim ILW store on the AP1000 site. The ILW store will be built in three phases. Each phase will be sized for 20 years of expected waste arisings. Phases 2 and 3, if required, will be sized based on actual operational waste data. This allows operational data to be incorporated into additional phases.

For additional information on the design of the onsite ILW store, refer to the “Radioactive Waste Arisings, Management and Disposal” [Ref. 36]. Also see section 2.1.4 of the Long Term Storage of ILW and Spent Fuel document [Ref. 33].

The ILW resulting from decommissioning an AP1000 is displayed in table 3.5-10 and Appendix A3 of the ER [Ref. 3]. The raw ILW arising through decommissioning is 689m^3 plus 85m^3 from decontamination operations, equating to a total volume of 774m^3 (unconditioned) ILW.

9.2 Package Lifetime and Timescale for Storage

As described in Section 8.8, in the absence of aggressive chemicals, and under suitably controlled ambient conditions, a 3m^3 package with a typical 2 mm thickness would be expected to take around 10,000 years [Ref. 7] to corrode through. The LoC process, carried out during the specific site stage will assess the performance of the package for its intended lifecycle.

The design life of the onsite ILW store is 100 years (Section 3.5.8.2 of the ER [Ref. 3]). The total inventory is based on 60 years waste arisings from the operation of one AP1000 unit.

The national ILWR is expected to be available within this period.

9.3 Demonstration that Conditioned Wastes Will Remain Within Agreed Specification for Final Disposal Throughout the Storage Period

As outlined in Sections 8.8 and 8.10, the waste containers used will be approved RWMD waste containers, and conditions within the ILW store will match the requirements for long-term storage of ILW, which will endeavour to maintain the integrity of the waste package and its container.

If the radionuclides in an ILW package have decayed such that the package could be LLW, the package will be temporarily placed in an LLW storage area. This will be calculated from historical data and the package inventory (recorded during conditioning), then checked using the HRGS and other suitable measuring equipment The LLW disposal facility will be contacted to ensure the appropriate records are prepared for LLW disposal at that time.

The NDA disposability assessment [Ref. 27] states that: "the proposals for the packaging of operational and decommissioning ILW have been judged to be compatible with RWMDs current plans for transport to and disposal of ILW in the GDF."

For further information, see the "Radioactive Waste Arisings, Management and Disposal," [Ref. 36].

9.4 How Passive Safety Will Be Achieved

How passive safety is achieved during handling, conditioning and storage of ILW is described in Section 8.1.

9.5 Integrity of Storage Arrangements

A preliminary safety statement [Ref. 22], HAZOP 0 safety study [Ref. 23], and HAZOP 1 safety study [Ref. 26] have been completed, during which ILW store integrity and accident performance were addressed. The proposed GDA ILW store designs address many of these issues; others are carried through to detailed design.

The ILW store is designed for 100 years of storage life. During design and construction, all appropriate design codes and standards for a building to last 100 years will be used. The ILW store crane is of a suitable integrity level and equipped with an interface grapple suitable for engagement with twistlock type features of a standard waste package of RWMD approved design.

The environmental conditions within the ILW store will be compliant with the specifications outlined by the RWMD (Nirex) [Ref. 5].

Additional information on the storage arrangements can be found in the "Radioactive Waste Arisings, Management and Disposal," [Ref. 36] and subsection 3.4.8 of the environment report [Ref. 3].

Further development of the ILW store is required. This will be done during the design process that will be undertaken by the individual site licensees.

The $3m^3$ packages are designed to withstand a drop from a height of 10m onto a flat unyielding surface resulting in a loss of contents of no more than 40ųm particles [Ref. 5]. The maximum height of stacked packages in the ILW store is less than 10m. ILW packages in transit will be kept as low to the ground surface as possible to ensure minimum drop height.

The ILW packages will be placed in the ILW store layer by layer, to limit the potential topple height of stored packages. The layers will be constructed from the furthest point of the store working back to the receipt area. The chosen transfer path for placing/retrieving a package will be such to minimise the effective drop height and overflight of stored packages.

9.6 Arrangements for Leak Detection

The ILW store will be fitted with alpha and beta/gamma monitors to detect any leaks in activity as outlined in the "Radioactive Waste Arisings, Management and Disposal," [Ref. 36] and subsection 3.5.8 of the ER [Ref. 3]. The ILW store will be a sealed weatherproof building preventing ingress of liquid into the vault. This will be monitored through the HVAC and environmental equipment used within the ILW store.

The AP1000 radiological monitoring arrangements are described in section 6.2.1 of the ER [Ref. 3].

The stored packages will be routinely inspected for corrosion and damage; any non-conforming packages will be overpacked as described in Section 8.15. The stored package monitoring strategy [Ref. 29] will be developed during the specific site design stage by the licensee.

9.7 Details of Ventilation Requirements and Filtration of Airborne Releases

The ILW store will have its own independent ventilation system as detailed in the "Radioactive Waste Arisings, Management and Disposal," [Ref. 36] and outlined in section 3.5.8.2 of the ER [Ref. 3] to ensure the required storage conditions for ILW packages, as described in Section 8.8, are maintained. If required, appropriate high efficiency particulate air filtration stages will be included prior to any releases to atmosphere.

The ILW store ventilation system will be designed to current regulations and will meet current environmental requirements.

9.8 Environmental Monitoring Arrangements

The AP1000 environmental monitoring arrangements are described in section 6 of the Environment Report [Ref. 3].

The environmental conditions within the ILW store will be compliant with the specifications outlined by RWMD (Nirex) [Ref. 5] or the regulators. To achieve this, the ILW store will contain thermometers and hygrometers. Additional information on the storage arrangements can be found in the "Radioactive Waste Arisings, Management and Disposal," [Ref. 36].

Additional research is required to determine what environmental conditions are required within the ILW store. This will be developed in line with any regulatory requirements by the individual site licensee.

9.9 How Stored Waste Will Be Retrieved and Inspected

The ILW store will be equipped with a waste tracking system, which will ensure that the location of individual waste packages can be established. This tracking system shall also record data relating to the package, such as reference number, radiological inventory, and production date in compliance with RWMD requirements in this regard.

The ILW store will also be equipped with a high integrity crane, which will be of a suitable integrity level and equipped with an interface grapple suitable for engagement with the twistlock type features of a standard waste package of RWMD-approved design.

Packages when required for inspection will be transferred to the import and inspection area of the ILW store. This area will be equipped with CCTV cameras and viewing windows to visually inspect the package. This may be developed by the Licensee during site specific detail design.

For further information on these systems, refer to subsection 3.5.8.2 of the ER [Ref. 3] and the "Radioactive Waste Arisings, Management and Disposal," [Ref. 36].

9.10 How Packages that Show Evidence of Deviating from Specification During Storage Will Be Managed

The facility will exist to observe the waste packages within the ILW store via CCTV and viewing windows, as described in Section 9.9 If a waste package shows evidence of deviating from the specification during storage (e.g., via corrosion or damage), it will be placed in an allotted area within the ILW store and potentially put into a secondary containment vessel as described in Section 8.15.

Refer to section 3.5.8.2 of the ER [Ref. 3] and “Radioactive Waste Arisings, Management and Disposal,” [Ref. 36] for further information.

10. CONTROL, ACCOUNTANCY, AND RECORDS

10.1 Arrangements for Recording Information that May Be Required in Future to Facilitate Subsequent Management of Radioactive Substances and Facilities

The records required to support the safe management of radioactive wastes during long-term storage and ultimately final disposal will need to be accumulated and retained for a long time (100+ years). As a result, consideration will be given to the content of such records and the form in which they are kept. The nuclear operator will hold the records until the responsibility for the wastes and materials has been passed to another body, such as the operator of a disposal facility (that is, the ILWR).

Management and record keeping procedures will be adopted to facilitate the subsequent management of ILW waste packages. For example, the contents of each ILW waste package and its encapsulation will be recorded and bar codes will be used to identify the waste containers located in the ILW store. These records will allow the tracking of individual packages from generation to disposal. It will be up to the specific site licensees to implement these procedures. These are outlined at a strategic level in sections 3.2 and 3.3 of the IWS [Ref. 18] and in section 3.5.8.2 of the ER [Ref. 3].

The Regulators have provided joint guidance on the managing of information relating to radioactive waste in the United Kingdom, which will be followed and referred to for further information [Ref. 11]. Additional information is also available in the IAEA publications, “Development of Specifications for Radioactive Waste Packages” [Ref. 30]. Licensees will provide up-to-date and accurate information on radioactive waste to the Regulators for inclusion in the UK Radioactive Waste Inventory [Ref. 37].

Strategic level detail is found in sections 3.2 and 3.3 of the IWS [Ref. 18]. The LCSR [Ref. 28] will contain information on quality assurance of safety-related documentation. The document and records management procedures to be adopted by the site-specific licensee during operation of an AP1000 are outlined in section 9.3.5 of the LCSR.

The actual arrangements for recording information will be determined by the specific site licensee.

10.2 Ongoing Measures to Demonstrate Whether Compliance with Requirements and Standards Have Been Achieved

The site-specific licensee will assume responsibility for safety and environmental management through the operating life and eventual decommissioning of the plant. This will include the implementation of procedures for demonstrating whether compliance with requirements and standards has been achieved.

The AP1000 Nuclear Power Plant sites will be regularly audited by an independent regulators (potentially the ND, EA and RWMD) to ensure that compliance with requirements and standards are in the first instance achieved and then maintained.

The waste management processes will be regularly assessed by the licensee as part of their quality management procedures (see Section 5.12). The management procedures outlined in Section 10.1 will also aid in the demonstration that compliance with requirements and standards are being achieved.

Further guidance can be obtained from the joint guidance issued by the regulators [Ref. 11].

Further development of ongoing measures to demonstrate compliance with requirements and standards has been achieved will be developed by the licensee of each specific site.

Strategic level detail is found in Sections 3.2 and 3.3 of the IWS [Ref. 18]. The LCSR [Ref. 28] will contain information on quality assurance of safety-related documentation.

The specific site licensee will determine what measures are employed to demonstrate whether compliance with requirements and standards has been achieved.

The licensee will also carry out periodic reviews of safety cases in conjunction with the HSE as specified in License Condition 15 to establish if compliance with requirements and standards has been achieved (see Section 4.2.8)

The AP1000 sites will also be regularly audited by the regulator to ensure that compliance with requirements and standards are in the first instance achieved and then maintained (see Section 4.2.6).

10.3 Timescales Over Which Such Information Shall be Recorded and Retained

The information recording and management systems developed by the licensee, as outlined in Section 10.1, will ensure that the timescales for which information is recorded and retained are compliant with the joint guidance issued by the regulators [Ref. 11].

The licensee will retain records until the responsibility for the wastes and materials has been passed to another body such as the operator of a disposal facility. However, in addition to this, the licensee will retain plant safety documentation for a period of 30 years following the decommissioning and decontamination of the plant (see section 9.3.5 of the LCSR [Ref. 28]).

The licensee will also implement a procedure for keeping records under review that takes into account the continuing relevance of the information, the suitability of the medium on which it is stored and the needs and expectations of stakeholders.

Additional guidance is also available in the IAEA publication [Ref. 30], this will be incorporated into the licensee’s information management system as appropriate.

10.4 Environmental Conditions for Storage and Long-Term Preservation of Records

Information regarding the long-term preservation of records is provided in the joint guidance issued by the regulators [Ref. 11]. The guidance provides advice on the recording mediums, appropriate data formats, the use of contextual information and record storage facilities.

The licensee will incorporate this guidance in the development of their information recording and management systems. The licensee will also discuss the requirements of the next waste custodian and other stakeholders, in order to select the most appropriate recording media. Once selected, the licensee will demonstrate the adequacy of its chosen storage medium/media, including redundancy or duplicate records, and will specify how it will review those arrangements in the future.

The NDA should in future establish standards, procedures and guidance for the National Nuclear Archive which licensee’s can adopt so as to ensure that records are produced to the required standard,.

The environmental conditions for storage and long-term preservation of records will be determined by the specific site licensee.

11. FUTURE DEVELOPMENT

In order for a comprehensive RWMC to be produced for the ILW generated by an AP1000, further research or development of designs is required as outlined in the table below.

Item Number	Future Research or Development
ILW 1	Monitoring regime for the required environmental conditions within ILW store
ILW 2	A programme for demonstrating the continuing compliance of waste stored within the storage limits
ILW 3	Ongoing measures to demonstrate whether compliance with requirements and standards has been achieved
ILW 4	Provide estimates of the quantity of organic material in the waste packages
ILW 5	Provide information on the types of resins present in the waste
ILW 6	Provide information on the grade and composition of stainless steel used in an AP1000 NPP, taking account of the nitrogen impurities in the steel and provide information on the nature of tritium, C-14 and Ar-39 in activated metals
ILW 7	Provide more detailed information on the chemistry of the wastes, including toxic element content
ILW 8	Confirm that the contents of the waste packages meet the 'contents specification', for example that masses of both deuterium and beryllium in the waste packages are less than 1.8g and that the specific limitations on quantities of graphite, exotic fissile materials, moderating materials and favourable sites for sorption of fissile material will be met
ILW 9	Provide information on the form of tritium and C-14 in the waste packages to support realistic modelling of their release during transport and operation
ILW 10	Provide further information and justification for the scaling factors used to derive I-129 inventories
ILW 11	Provide information on the products that would be generated from waste degradation, for example the rates of volatile amines produced by radiolysis and thermal degradation of anion-exchange resins
ILW 12	Demonstrate that the grout used for the conditioning of the waste infiltrates the waste and immobilises particulates successfully and that wastes are retained in the body of the waste form, for example confirm that free liquids will not be present in the filters and demonstrate that grout infiltrates the filters, immobilises particulates successfully and minimises voidage
ILW 13	Develop appropriate waste conditioning process envelopes, demonstrate that the plant operational envelope falls within this and establish acceptable evolution performance of the resulting wasteforms, for example develop an appropriate formulation envelope for Organic Primary and Secondary Resins that considers the presence of borate within the wastes

Item Number	Future Research or Development
ILW 14	Consider the use of alternative approaches to grouting waste, such as the use of organic polymers as an alternative to the use of cementitious grouts for conditioning
ILW 15	Demonstrate that the packaging of AP04 ILW steel has appropriately considered the distribution of radioactivity associated with the waste, and that dose rates are not affected by placing the steel near the edges of the packages
ILW 16	Provide data on the mass transport, thermal conductivity, gas generation and pressurisation properties of the waste forms
ILW 17	Provide results from modelling or test work to better define the damage and the release from waste packages under impact accidents, and the heat loading and the release from the waste packages from fire accidents
ILW 18	Consideration of the impact from any detrimental effects due to chemical species that may be present in wastes or might reasonably be expected to form
ILW 19	Consider the deterioration in the mechanical strength of waste packages owing to storage, and the impact of such deterioration on the accident performance
ILW 20	An evaluation of the long-term performance of the waste form
ILW 21	An evaluation of any reactions that may take place between the waste and the conditioning matrix
ILW 22	Demonstration that the conditioned wastes will remain within the agreed specification for final disposal throughout the storage period
ILW 23	Use of and implications for existing waste disposal routes if the preferred option is selected
ILW 24	Provide data to support proposed management options for Rod Cluster Control Assemblies
FAP1	The hazard categorisation of the AP1000 NPP radwaste treatment operations will be dependent on the specific site and licensee and will be determined during detailed design.
FAP2	The organisational arrangements for safety management will be determined by the potential licensee of the AP1000 NPP during detailed design.
FAP3	Additional detailed design work and safety case production will be required post the GDA and the project review points will be determined by the licensee of the AP1000 NPP during this phase.
FAP4	The QA arrangements for the AP1000 NPP radwaste treatment operations will be dependent on the specific site and will therefore be determined by the licensee during detailed design.
FAP5	The management arrangements that will deal with radiological accidents and incidents will be determined during the detailed design phase of the AP1000 NPP radwaste treatment operations.

Item Number	Future Research or Development
FAP6	Procedures for shutdown, interim clean-out and maintenance of the mobile encapsulation plant, Radwaste Building and the ILW Store will be produced during detailed design.
FAP7	The expected dose uptake during normal operations will be confirmed on completion of the dose budget assessment.
FAP8	The safety of the facilities with regard to chemotoxic, environmental and conventional safety will be considered in more detail in the detailed design.
FAP9	The HAZOP actions need to be reviewed and closed out during detailed design.
FAP10	Consideration of the return periods of extreme environmental events will be agreed with the Regulatory Authorities prior to commencement of detail design work for specific site locations.
FAP11	The adequacy of the safeguards to meet their safety functions and provide appropriate integrity levels will be assessed during detailed design.
FAP12	The detailed design of the vessels, pipework and connections to the mobile encapsulation plant will be reviewed during detailed design to ensure that they satisfy all radiological and HSE requirements.
FAP13	The modelling of the potential generation rate of hydrogen will need to be considered further during detailed design.

The full list of research requirements are detailed in table 1 of the Long Term Storage of AP1000 NPP ILW and Spent Fuel document [Ref. 33]. The table specifies the assigned actionee for each item along with the timeframe for completion of the research. The research deliverables are shown within the ILW disposability plan [Ref. 33] which is reproduced in Appendix 3. Items ILW 4 to 19 match issues identified as future LoC interactions by the NDA [Appendix B of Reference 27].

12. CONCLUSIONS

Westinghouse believes that the evidence provided in this report is consistent with the level of detail required at this stage of the GDA. Section 11 of this report outlines some areas where additional development work or research is required to adequately fulfill the information requirements; however, these do not impact on the current status of the design, and are issues that will be resolved through the natural progression of the detailed design of the facilities.

Westinghouse believes that there is sufficient information provided through the GDA to allow licensees to produce a detailed RWMC for ILW during the site licensing phase.

13. REFERENCES

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3. UKP-GW-GL-790 Rev. 4, "UK AP1000 Environment Report," Westinghouse Electric Company LLC, 2009.

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APPENDIX 1
SUPPORTING INFORMATION CHECKLIST

Appendix 1 – Supporting Information Checklist

Supporting Information Checklist

Section	RWMC Requirements	ER(1)	PCSR	IWS	DA	Supporting Documentation	Prime Source	Comments
5	GENERAL REQUIREMENTS							
5.1	Waste Streams	3, App. A	✓	✓		DCD [Ref. 16], Process mass balance [Ref. 15]	ER [Ref. 3]	None
5.2	Current Ownership of the Waste Streams	n/a	n/a	n/a	n/a	n/a	n/a	None
5.3	Management Strategy for the Waste Streams	3.5.1			✓	NDA data sheet submission [Ref. 29].	ER [Ref. 3]	None
5.4	Proposed Waste Management Processes	3.5,		6		BAT assessment [Ref. 6]	ER [Ref. 3]	None
5.5	Relevant Buildings and Plant	2.3.6.2	7			DCD section 11.4 [Ref. 16]	DCD [Ref. 16]	None
5.6	Facility, Organisation, and Management of Radioactive Waste	3	15	3		LCSR section 3 [Ref. 28], QMS [Ref. 31]	PCSR [Ref. 17]	None
5.7	Interdependencies Among All Steps in Generation and Management of Radioactive Waste Management.			3, 4			IWS [Ref. 18]	None
5.8	How the Generation of Radioactive Waste is Minimised	3.2, 3.5.4		3.1.1			ER [Ref. 3]	None

Notes:

1. ER = Environment Report
   PCSR = Pre-construction Safety Report
   IWS = Integrated Waste Strategy
   DA = NDA Disposability Assessment
   ✓ – Indicates that information relating to the specific area is included in the corresponding document. Refer to the appropriate section of this report for specific details of the information included in the corresponding document.

Numbers in each cell represent the sections of the document that contains the supporting information

Appendix 1 – Supporting Information Checklist

Information Requirements Checklist (cont.)

Section	RWMC Requirements	ER	PCSR	IWS	DA	Supporting Documentation	Prime Source	Comments
5.9	How Radioactive Waste Is Adequately Controlled and Contained	3. 5,	3, 11	6		BAT assessment [Ref. 6], Nirex Generic Waste Package Specification [Ref. 5], DCD sections 3, 4, and 5 [Ref. 16], Radioactive Waste Arisings, Management and Disposal [Ref. 36]	ER [Ref. 3]	None
5.10	How Safeguards and Security Issues Will Be Addressed		✓			Nuclear industry security regulations (NISR 03) [Ref. 19], LCSR [Ref. 28]	PCSR [Ref. 17]	To be fully developed in plant safety cases.
5.11	How Radioactive Waste Meets Relevant Requirements to Enable Its Transport	2.9, 3.4.9.3			✓	EA waste classification definitions [Ref. 21] Transport regulations [Ref. 25], RWMD (Nirex) transport report [Ref. 24]	ER [Ref. 3]	Final process to be fully developed.
5.12	Quality Assurance Arrangements	1.4	1.5.2			LCSR section 3 [Ref. 28], QMS [Ref. 31], Project quality plan [Ref. 32]	ER [Ref3]	None
5.13	Information and Records Management Arrangements	1.4.3		3.2, 3.3			IWS [Ref. 18]	None

Information Requirements Checklist (cont.)

Section	RWMC Requirements	ER	PCSR	IWS	DA	Supporting Documentation	Prime Source	Comments
6	RADIOACTIVE WASTE MANAGEMENT STRATEGY							
6.1	Subsidiary or Secondary Waste Streams Produced	3.5						None
6.2	Identification of Ultimate Destinations for the Wastes, Be It Disposal or Long-Term Storage	3.5.9.2		6	✓		ER [Ref. 3]	None
6.3	Options and Processes Considered to Convert Raw Waste into a Product Suitable for Long-Term Storage	3.5.5	✓			BAT assessment [Ref. 6]	ER [Ref. 3]	None
6.4	Reasons and Assumptions Used to Reject Options	3.5				BAT assessment [Ref. 6]	ER [Ref. 3]	None
6.5	Reasons, Assumptions, Uncertainties, Calculations, and Conclusions for Selecting Preferred Option(s)	3.5				BAT assessment [Ref. 6]	ER [Ref. 3]	None
6.6	How Preferred Option Is Consistent with the Integrated Waste Strategy			6.8			IWS [Ref. 18]	None
6.7	How Preferred Option Is Consistent with Existing and Reasonably Foreseeable Provisions for Transport, Storage, and Disposal	3.5.9				BAT assessment [Ref. 6], Transport regulations [Ref. 25], RWMD (Nirex) transport report [Ref. 24]	BAT assessment [Ref. 6]	None
6.8	Details of Stakeholder or Public Consultation			4.7			IWS [Ref. 18]	None
6.9	Use of and Implications for, Existing Waste Disposal Routes if Preferred Option Is Selected				✓		DA [Ref. 27]	Waste disposal route to be developed in site specific design

Information Requirements Checklist (cont.)

Section	RWMC Requirements	ER	PCSR	IWS	DA	Supporting Documentation	Prime Source	Comments
7	WASTE MINIMISATION, CHARACTERISATION, AND SEGREGATION							
7.1	Description of Techniques Adopted to Prevent or Minimise Arisings	3.2, 3.5.4		3.1.1			ER [Ref. 3]	None
7.2	Details of Methods Used for Segregation and Characterisation of Wastes and Practicable Steps Taken to Avoid Dilution						]	None
7.2.1	Segregation	3.5			✓	IAEA safety glossary [Ref. 4], Radioactive Waste Arisings, Management and Disposal [Ref. 36], Nirex Generic Waste Package Specification [Ref. 5], Regulator guidance on minimisation and segregation [Ref. 2]	ER [Ref. 3]	None
7.2.2	Characterisation					Regulator guidance on minimisation and segregation [Ref. 2], Radioactive Waste Arisings, Management and Disposal [Ref. 36], Nirex Generic Waste Package Specification [Ref. 5].	Regulator guidance on minimisation and segregation [Ref. 2],	None
7.2.3	Dilution Avoidance	n/a	n/a	n/a	n/a	n/a	n/a	None
7.3	Evidence that Waste Streams Can be Characterised to Level Necessary to Ensure Compliance with Specification for Waste Packaging				✓		DA [Ref. 27]	None

Information Requirements Checklist (cont.)

Section	RWMC Requirements	ER	PCSR	IWS	DA	Supporting Documentation	Prime Source	Comments
8	CONDITIONING AND DISPOSABILITY							
8.1	How Passive Safety Will Be Achieved	3.5	6.5.22			DCD section 11.4 [Ref.16].	ER [Ref. 3]	None
8.2	Evidence that Waste Package Produced Will Be Consistent with Existing and Reasonably Foreseeable Provisions for Transport, Storage, and Disposal	3.5.9			✓	RWMD (Nirex) report - Transport of nuclear waste, [Ref. 24], Transport regulations [Ref. 25].	DA [Ref. 27]	None
8.3	Identification of any Significant Issues that may Challenge Disposability				✓		DA [Ref. 27]	None
8.4	Intended Specification for Waste Package				✓	RWMD (Nirex) generic waste package specification [Ref. 5]	generic WPS [Ref. 5]	None
8.5	How Inventory of Individual Packages Will Be Controlled and Measured	n/a	n/a	n/a	n/a	n/a	n/a	None
8.5.1	Ion Exchange Resin/Activated Carbon	✓				DCD [Ref. 16], Radioactive Waste Arisings, Management and Disposal [Ref. 36].	ER [Ref. 3]	None
8.5.2	Waste Filters	✓				DCD section 11.4.2.3.2 [Ref. 16], Radioactive Waste Arisings, Management and Disposal [Ref. 36]	DCD [Ref. 16]	None
8.6	Demonstration that Proposed Packaging and Conditioning Strategy Uses BPM/BAT to Minimise Long-Term Environmental Impact and Ensure Associated Doses Are ALARP	3.5.5				BAT assessment [Ref. 6], Radioactive Waste Arisings, Management and Disposal [Ref. 36].	ER [Ref. 3]	None

Information Requirements Checklist (cont.)

Section	RWMC Requirements	ER	PCSR	IWS	DA	Supporting Documentation	Prime Source	Comments
8.7	Demonstration that Proposed Strategy Will Not Lead to Significant Increases in the Possibility of a Neutron Chain Reaction in a Disposal Facility	n/a	n/a	n/a	n/a	n/a	n/a	None
8.8	Assessment of Long-Term Performance and Degradation of Waste Containers					EA Review Longevity of ILW Packages for Geological Disposal [Ref. 7], Radioactive Waste Arisings, Management and Disposal [Ref. 36], NDA Proposed Research and Development Strategy [Ref. 9], Guidance on the Monitoring of Waste Packages during Storage [Ref. 29].	[Ref. 7],	Using RWMD approved containers; therefore, expected to be no fundamental issue; long term performance unknown

Information Requirements Checklist (cont.)

Section	RWMC Requirements	ER	PCSR	IWS	DA	Supporting Documentation	Prime Source	Comments
8.9	Identification of Any Potential Package Failure Mechanisms					Radioactive Waste Arisings, Management and Disposal [Ref. 36], Preliminary safety statement [Ref. 22], HAZOP 0 safety study [Ref. 23], HAZOP 1 safety study [Ref. 26]	Preliminary safety statement [Ref 22], HAZOP 0 [Ref. 23], HAZOP 1 [Ref. 26]	None
8.10	Evaluation of Any Reactions that May Take Place Between the Waste and the Conditioning Matrix	3.5			✓	EA Review Longevity of ILW Packages for Geological Disposal [Ref. 7], BNFL Immobilisation of Intermediate Level Wastes [Ref. 8], Radioactive Waste Arisings, Management and Disposal [Ref. 36], RWMD (Nirex) report “Waste stream 3S12 CVCS resin and spent resins” [Ref. 10].	ER [Ref. 3]	No fundamental issues outstanding, however, additional research required as part of design of ILW facilities
8.11	Evaluation of Long-Term Performance of Waste Form	✓				EA Review Longevity of ILW Packages for Geological Disposal [Ref. 7], BAT assessment [Ref. 6]	EA Review Longevity of ILW Packages for Geological Disposal [Ref. 7]	Additional research required as long-term performance not known

Information Requirements Checklist (cont.)

Section	RWMC Requirements	ER	PCSR	IWS	DA	Supporting Documentation	Prime Source	Comments
8.12	Assessment of Potential for Gas Generation from Wastes in Long-Term	✓				Gas Generation and Migration from a Deep Geological Repository for Radioactive Waste [Ref. 12], Simplified Model of Gas Generation from Radioactive Wastes [Ref. 13], Comparison of Gas Generation and Gas Transfer Analyses [Ref. 14], NDA Proposed Research and Development Strategy [Ref. 9].	[Ref. 12]	Challenge of modelling gas generation; its long-term effects a key issue
8.13	Consideration of Impact of Toxic Materials as a Result of Release from a Disposal Facility and Environmental Impacts that Might Arise During, or as a Result of, Operations	3.5.8.2	4.4			DCD [Ref. 16]	DCD [Ref. 16]	None
8.14	Impact from Any Detrimental Effects due to Chemical Species That May Be Present in the Wastes or Might Reasonably Be Expected to Form				✓		DA [Ref. 27]	NDA has judged current proposals for transport and disposal to be compatible with the RWMD's plans. However, additional research in this area is required and it will occur as the natural progression of the design of the ILW facilities.
8.15	How Conditioned Waste that Does Not Meet Specifications Will Be Managed	3.5.8.2				Radioactive Waste Arisings, Management and Disposal [Ref. 36].	ER [Ref. 3]	None

Information Requirements Checklist (cont.)

Section	RWMC Requirements	ER	PCSR	IWS	DA	Supporting Documentation	Prime Source	Comments
8.16	Arrangements for Quality Assurance and Records	3.5, 1.4	1.5.2	3.2, 3.3		EA guidance on managing information [Ref. 11], LCSR section 3 [Ref. 28], QMS [Ref. 31], Project quality plan [Ref. 32]	ER [Ref. 3]	Will be developed during detailed design of facilities.
8.17	How Developments in Disposal Facility Requirements Will Be Taken Into Account	n/a	n/a	n/a	n/a	n/a	n/a	None
9	STORAGE OF RADIOACTIVE WASTE							
9.1	Storage Capacity Requirements	3, App. A3				Radwaste mass balance [Ref. 15], Radioactive Waste Arisings, Management and Disposal [Ref. 36].	ER [Ref. 3]	None
9.2	Package Lifetime and Timescale for Storage	3.5.8.2				EA Review Longevity of ILW Packages for Geological Disposal [Ref. 7	ER [Ref. 3]	None
9.3	Demonstration that Conditioned Wastes Will Remain Within Agreed Specification for Final Disposal Throughout the Storage Period				✓	Radioactive Waste Arisings, Management and Disposal [Ref. 36]	DA [Ref. 27]	NDA has judged current proposals for disposal to be compatible with the RWMD’s plans. However, additional research in this area is required and will occur as the natural progression of the design of the ILW facilities.
9.4	How Passive Safety Will Be Achieved	3.5	6.5.22			DCD section 11.4 [Ref.16].	ER [Ref. 3]	None

Information Requirements Checklist (cont.)								
Section	**RWMC Requirements**	**ER**	**PCSR**	**IWS**	**DA**	**Supporting Documentation**	**Prime Source**	**Comments**
9.5	Integrity of Storage Arrangements	3.4.8				Preliminary safety statement [Ref. 22], HAZOP 0 safety study [Ref. 23], HAZOP 1 safety study [Ref. 26], RWMD (Nirex) (2005). Waste package specification and guidance documentation [Ref. 5], Radioactive Waste Arisings, Management and Disposal [Ref. 36].	ER [Ref. 3]	None
9.6	Arrangements for Leak Detection	3.5.8, 6.2.1				Radioactive Waste Arisings, Management and Disposal [Ref. 36], Stored package monitoring strategy [Ref. 29]	ER [Ref. 3]	None
9.7	Details of Ventilation Requirements and Filtration of Airborne Releases	3.5.8.2				Radioactive Waste Arisings, Management and Disposal [Ref. 36]	ER [Ref. 3]	None
9.8	Environmental Monitoring Arrangements	6				RWMD (Nirex) (2005). Waste package specification and guidance documentation [Ref. 5], Radioactive Waste Arisings, Management and Disposal [Ref. 36].	ER [Ref. 3]	Monitoring and control of the environmental conditions within the ILW store to be determined during detailed design of facility and to be agreed with regulator and RWMD
9.9	How Stored Waste Will Be Retrieved and Inspected	3.5.8.2				Radioactive Waste Arisings, Management and Disposal [Ref. 36]	ER [Ref. 3]	None

Information Requirements Checklist (cont.)

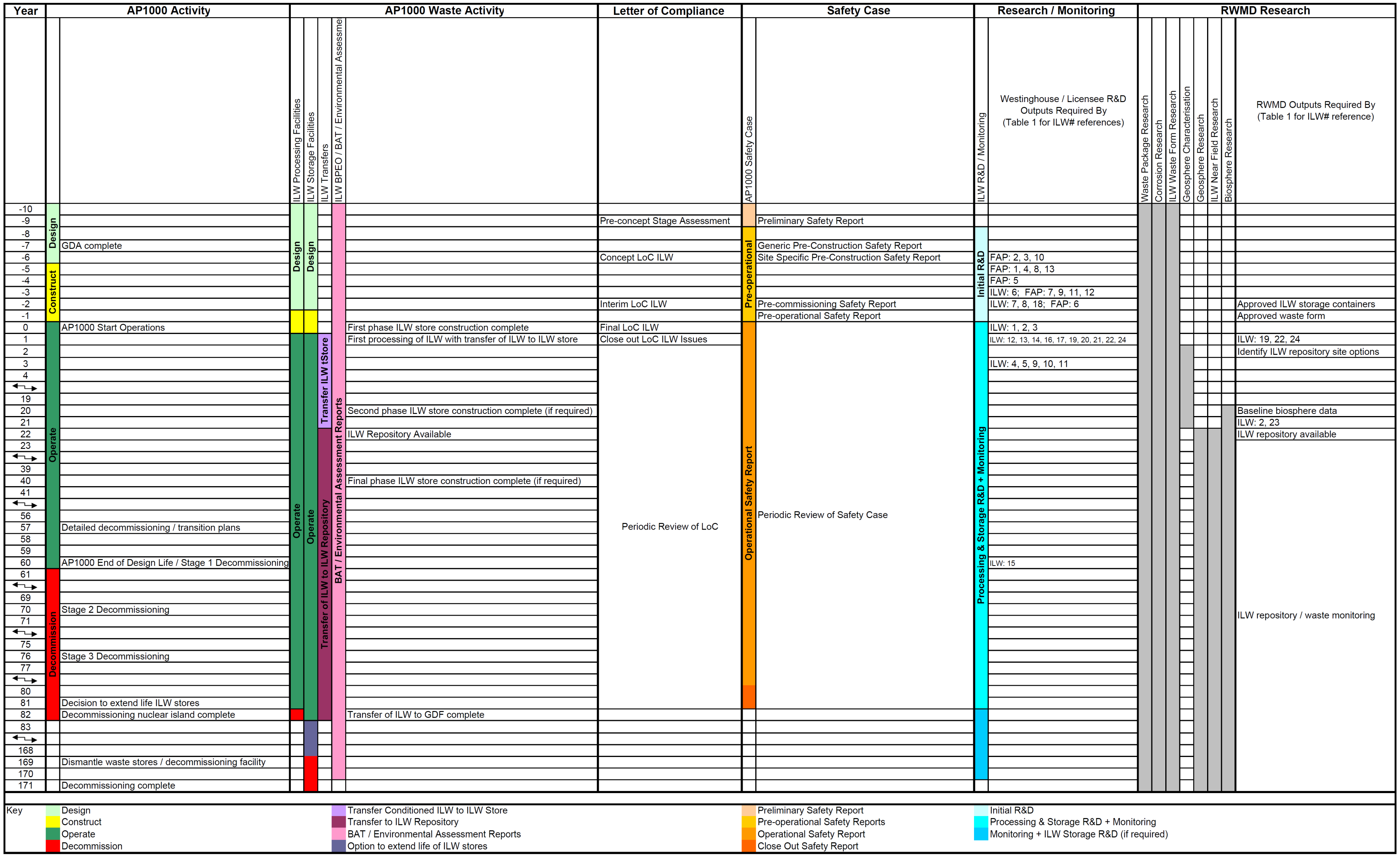
Section	RWMC Requirements	ER	PCSR	IWS	DA	Supporting Documentation	Prime Source	Comments
9.10	How Packages that Show Evidence of Deviating from Specification During Storage Will Be Managed	3.5.8.2				Radioactive Waste Arisings, Management and Disposal [Ref. 36]	ER [Ref. 3]	None
10	CONTROL, ACCOUNTANCY, AND RECORDS							
10.1	Arrangements for Recording Information that May Be Required in Future to Facilitate Subsequent Management of Radioactive Substances and Facilities	3.5.8.2		3.2, 3.3		EA Guidance on managing information relating to radioactive waste in the united kingdom [Ref. 11], IAEA report – development of specification for HLW packages [Ref. 30], LCSR section 9.3.5 [Ref. 28], UK Radioactive Waste Inventory [Ref. 37].		This information will be incorporated into the procedures written by the licensee
10.2	Ongoing Measures to Demonstrate Whether Compliance with Requirements and Standards Have Been Achieved	3		3.2, 3.3		EA Guidance on managing information relating to radioactive waste in the united kingdom [Ref. 11], LCSR [Ref. 28]		This information will be incorporated into the procedures written by the licensee
10.3	Timescales Over Which Such Information Shall be Recorded and Retained					EA Guidance on managing information relating to radioactive waste in the United Kingdom [Ref. 11], LCSR section 9.3.5 [Ref. 28], [Ref. 30]		This information will be incorporated into the procedures written by the licensee
10.4	Environmental Conditions for Storage and Long-Term Preservation of Records					EA Guidance on managing information relating to radioactive waste in the united kingdom [Ref. 11].		This information will be incorporated into the procedures written by the licensee

APPENDIX 2
GLOSSARY OF TERMS

Glossary of Terms	
ALARP	As Low As Reasonably Practicable
BAT	Best Available Techniques
BPM	Best Practicable Means
CfA	Conditions for Acceptance
DCD	AP1000 European Design Control Document
EA	Environment Agency
ER	Environment Report
FCPHD	Filter Cask Portable Handling Device
GDA	Generic Design Assessment
GDF	Geological Disposal Facility
HAZOP	Hazard and Operability
HLW	High Level Waste
HRGS	High Resolution Gamma Spectroscope (a waste package assay instrument)
HSE	Health and Safety Executive
HSW	Health & Safety at Work
HVAC	Heating, Ventilation, and Air Conditioning
IAEA	International Atomic Energy Agency
ILW	Intermediate Level Waste
ILWR	Intermediate Level Waste Repository
IWS	Integrated Waste Strategy
IX	Ion Exchange
LC	Licence Condition
LCSR	Plant Lifecycle Safety Report
LLW	Low Level Waste
LoC	Letter of Compliance
MEU	Mobile Encapsulation Unit
NDA	Nuclear Decommissioning Authority
NII	Nuclear Installations Inspectorate
NIREX	Nuclear Industry Radioactive Waste Executive
NISR	Nuclear Industries Security Regulations
NPP	Nuclear Power Plant

Glossary of Terms	
NWAT	Nuclear Waste Assessment Team
OCNS	Office for Civil Nuclear Safety
PCSR	Pre-Construction Safety Report
QA	Quality Assurance
RWMC	Radioactive Waste Management Case
RWMD	Radioactive Waste Management Directorate
SCV	Secondary Containment Vessel
SEPA	Scottish Environment Protection Agency
VLLW	Very Low Level Radioactive Waste
Westinghouse	Westinghouse Electric Company LLC
WPS	Waste Package Specification
WPrS	Waste Product Specification

APPENDIX 3
ILW DISPOSABILITY PLAN



Year	AP1000 Activity		AP1000 Waste Activity					Letter of Compliance	Safety Case		Research / Monitoring		RWMD Research							
			ILW Processing Facilities	ILW Storage Facilities	ILW Transfers	ILW BPEO / BAT / Environmental Assessme			AP1000 Safety Case		ILW R&D / Monitoring	Westinghouse / Licensee R&D Outputs Required By (Table 1 for ILW# references)	Waste Package Research	Corrosion Research	ILW Waste Form Research	Geosphere Characterisation	Geosphere Research	ILW Near Field Research	Biosphere Research	RWMD Outputs Required By (Table 1 for ILW# reference)
-10						BAT / Environmental Assessment Reports			🟧				▨	▨	▨					
-9	Design		Design	Design				Pre-concept Stage Assessment		Preliminary Safety Report										
-8									Pre-operational		Initial R&D									
-7		GDA complete								Generic Pre-Construction Safety Report										
-6								Concept LoC ILW		Site Specific Pre-Construction Safety Report		FAP: 2, 3, 10								
-5	Construct											FAP: 1, 4, 8, 13								
-4												FAP: 5								
-3												ILW: 6; FAP: 7, 9, 11, 12								
-2								Interim LoC ILW		Pre-commissioning Safety Report		ILW: 7, 8, 18; FAP: 6								Approved ILW storage containers
-1			🟨	🟨						Pre-operational Safety Report										Approved waste form
0	Operate	AP1000 Start Operations	Operate	Operate			First phase ILW store construction complete	Final LoC ILW	Operational Safety Report		Processing & Storage R&D + Monitoring	ILW: 1, 2, 3								
1					Transfer ILW tStore		First processing of ILW with transfer of ILW to ILW store	Close out LoC ILW Issues				ILW: 12, 13, 14, 16, 17, 19, 20, 21, 22, 24								ILW: 19, 22, 24
2																▨				Identify ILW repository site options
3												ILW: 4, 5, 9, 10, 11								
4																				
↔																				
19																				
20							Second phase ILW store construction complete (if required)												▨	Baseline biosphere data
21																				ILW: 2, 23
22					Transfer of ILW to ILW Repository		ILW Repository Available										▨	▨		ILW repository available
23																				
↔																				
39																				
40							Final phase ILW store construction complete (if required)													
41																				
↔																				
56										Periodic Review of Safety Case										
57		Detailed decommissioning / transition plans						Periodic Review of LoC												
58																				
59																				
60		AP1000 End of Design Life / Stage 1 Decommissioning										ILW: 15								
61	Decommission																			
↔																				
69																				
70		Stage 2 Decommissioning																		ILW repository / waste monitoring
71																				
↔																				
75																				
76		Stage 3 Decommissioning																		
77																				
↔																				
80									🟥											
81		Decision to extend life ILW stores																		
82		Decommissioning nuclear island complete	🟥				Transfer of ILW to GDF complete				🟦									
83				🟪																
↔																				
168																				
169		Dismantle waste stores / decommissioning facility		🟥																
170																				
171		Decommissioning complete																		

Key
- 🟩 Design
- 🟨 Construct
- 🟩 Operate
- 🟥 Decommission
- 🟪 Transfer Conditioned ILW to ILW Store
- 🟪 Transfer to ILW Repository
- 🟪 BAT / Environmental Assessment Reports
- 🟪 Option to extend life of ILW stores
- 🟧 Preliminary Safety Report
- 🟨 Pre-operational Safety Reports
- 🟧 Operational Safety Report
- 🟥 Close Out Safety Report
- 🟦 Initial R&D
- 🟦 Processing & Storage R&D + Monitoring
- 🟦 Monitoring + ILW Storage R&D (if required)

Figure A3-1. ILW Disposability Plan