HORIZON NUCLEAR POWER

WYLFA NEWYDD

ENERGY WORKING FOR BRITAIN

Wylfa Newydd Project

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1 Introduction

1.1.1 This appendix provides an overview of the proposed management arrangements for all radioactive wastes and spent fuel arising during the operation and decommissioning of the Power Station. No radioactive waste would be generated during construction of the Power Station.

1.1.2 Operation and decommissioning of the Power Station would result in the unavoidable generation of quantities of radioactive waste and spent fuel. This is a known and justifiable consequence of nuclear power generation and the UK regulatory permissions regime for nuclear power stations defines precise regulatory requirements and expectations for the management of this waste.

1.1.3 Horizon will apply the principles of waste minimisation, so far as is reasonably practicable (SFAIRP), in the design of the Power Station. Wherever reasonably practicable, measures will be taken to prevent materials either becoming radioactively contaminated or activated, or as being classified as radioactively contaminated due to the inadvertent placement of inert material adjacent to radioactive material.

1.1.4 Waste processing systems have been specified to treat radioactive liquid and gaseous effluents and discharges and solid wastes in order to reduce the environmental impact as low as reasonably achievable (ALARA) prior to disposal. The activity and volume of radioactive wastes discharged and disposed of shall be minimised through the application of Best Available Techniques (BAT) and the use of the waste hierarchy.

1.1.5 Horizon's strategy will be to manage and process radioactive wastes as they arise where this is reasonably practicable, thereby reducing risks and preventing the creation of a legacy that has to be dealt with by future generations. The approach to radioactive waste management has been developed based on lessons learnt from the operation and decommissioning of the UK’s early nuclear power stations.

1.1.6 Potential radiological effects resulting from aerial and liquid discharges, and from the storage and transport of solid wastes, are summarised as part of the assessments within chapter D14 (Radiological effects, Application Reference Number: 6.4.14).

2 Legislation, policy and guidance

2.1 Introduction

2.1.1 This section summarises the policies and key authorities that Horizon works with regarding the management of radioactive wastes and spent fuel. Horizon's principles for the implementation of the strategy for the management of radioactive waste and spent fuel are also described. This demonstrates that there are clear systems and procedures in place to ensure that the radioactive waste and spent fuel will be handled and treated in compliance with legislation, policy, guidance and specifications.

2.2 Regulatory context

2.2.1 The management of wastes on a nuclear licenced site is the sole responsibility of the waste producer (i.e. the operator and site licensee). It is the waste producer that implements appropriate waste management operations on the Power Station Site in compliance with statutory legislation, policy, guidance and specifications. The UK Government, regulators and technical authorities have the following roles:

- the UK Government determines statutory legislation and policy in the light of international agreements and guidance;
- technical authorities specify requirements for the treatment and disposal of radioactive waste; and
- nuclear regulators enforce the radioactive waste legislation and ensure that policies are implemented.

2.2.2 The UK Advanced Boiling Water Reactor (UK ABWR) technology to be used for the Power Station is a progression of the boiling water reactor designs constructed and operated in Japan and the US, in compliance with their respective environmental legislation. ABWRs are already operational at four sites in Japan and are approved for use in the USA and Taiwan. No nuclear reactor could be constructed in the UK unless the nuclear regulators are completely satisfied that it can operate safely.

2.2.3 The nuclear regulators have undertaken the Generic Design Assessment (GDA) of the UK ABWR design to confirm that this technology will meet the UK's legislative and permitting standards [RD1]. In December 2017, the Office for Nuclear Regulation (ONR), the Environment Agency and Natural Resources Wales (NRW) issued Design Acceptance Confirmation and a Statement of Design Acceptability for the UK ABWR reactor design.

2.3 Key authorities

Nuclear regulators

2.3.2 The management of radioactive waste is a highly regulated activity with robust statutory legislation in place to minimise any adverse effect on human health

and the environment. All radioactive waste would be managed in accordance with legislation as enforced by regulators.

2.3.3 There are several regulators overseeing the enforcement of radioactive wastes that would be generated by the Wylfa Newydd Project. The regulators have different roles and responsibilities depending on the category of waste produced.

- The ONR regulates on-site radioactive waste management through conditions attached to the nuclear site licence. The ONR consults the appropriate environmental agency regarding radioactive waste management activities and would not issue the nuclear site licence (to the nuclear site operator) without taking full and meaningful account of any environmental issues raised.
- NRW regulates radioactive disposals (including the discharge of gaseous and aqueous emissions) and the transfer of radioactive wastes between the Power Station and waste treatment and disposal sites. NRW issues Environmental Permits and would regulate the transfer, treatment and disposal of all wastes (including the discharge of gaseous and aqueous wastes).

Nuclear Decommissioning Authority

2.3.4 The Nuclear Decommissioning Authority (NDA) is responsible for the decommissioning and clean-up of all legacy civil nuclear sites in the UK, including the management of radioactive wastes. The NDA establishes waste management plans with the operator and consults on these plans with the relevant regulators. The NDA has overall responsibility for implementation of UK lower activity waste (LAW) policy including the operation of the Low-Level Waste Repository (LLWR) near Drigg in Cumbria. The NDA is also responsible for the implementation of the UK higher activity waste (HAW) policy including the future operation of the Geological Disposal Facility (GDF) by Radioactive Waste Management.

2.3.5 With specific reference to the Wylfa Newydd Project, the NDA will advise the Department of Business, Energy and Industrial Strategy on the quality of decommissioning plans and associated cost estimates, as required for new Nuclear Power Stations under the UK Government Funded Decommissioning Programme (FDP) arrangements.

2.4 Summary of key legislation, policies and guidance

2.4.1 Table 2-1 lists the main UK legislation relevant to the management of radioactive waste and spent fuel. Table 2-2 identifies the main UK national strategy, policies and guidance that apply to the management of spent fuel and radioactive wastes, and therefore would be integral to Horizon's approach to this topic.

Table 2-1 UK legislation relevant to radioactive waste and spent fuel management

Legislation	Description
Nuclear Installations Act,1965	ONR grant nuclear site licences under this Act, and have a standard set of licence conditions. The licence holder is required to comply with defined licence conditions (LCs), as per schedule 2 of the standard nuclear site licence, which ensure the safe operation and maintenance of a nuclear installation. Standard LCs relevant to the management of waste on a licenced site include: • LC4: Restrictions on nuclear matter on the site, "The licensee shall ensure that no nuclear matter is stored on the site except in accordance with adequate arrangements made by the licensee for this purpose." • LC5: Consignment of nuclear matter, "The licensee shall not consign nuclear matter (other than excepted matter and radioactive waste) to any place in the United Kingdom other than a relevant site except with the consent of ONR." • LC32: Accumulation of radioactive waste, "The licensee shall make and implement adequate arrangements for minimising so far as is reasonably practicable the rate of production and total quantity of radioactive waste accumulated on the site at any time and for recording the waste so accumulated." • LC33: Disposal of radioactive waste, "The licensee shall, if so directed by ONR, ensure that radioactive waste accumulated or stored on the site is disposed of as ONR may specify and in accordance with an environmental permit, or an existing permit..." • LC34: Leakage and escape of radioactive material and radioactive waste, "The licensee shall ensure, so far as is reasonably practicable, that radioactive material and radioactive waste on the site is at all times adequately controlled or contained so that it cannot leak or otherwise escape from such control or containment." • LC35: Decommissioning, "The licensee shall make and implement adequate arrangements for the decommissioning of any plant or process which may affect safety." The ONR is responsible for issuing site licences as well as monitoring an operator's compliance with the LCs.
The Ionising Radiations Regulations 2017	Under these regulations, the exposure to radiation of the public and workers must be below legal limits and must be shown to be as low as reasonably practicable (ALARP). In this context, doses to workers must be kept ALARP while operating radioactive waste systems or handling radioactive waste.
Energy Act 2008 and 2013	Under section 45 of the Energy Act 2008, a person who applies for a nuclear site licence to install or operate a nuclear power station must notify the Secretary of State of the application and prepare a FDP for approval. It is an offence under section 47 of the Act for a person to use a

Legislation	Description
	site, or permit another person to use a site, by virtue of a nuclear site licence, without an approved FDP. The Energy Act 2013 established the ONR as the body responsible for the enforcement of statutory provisions within the Act in regard to nuclear regulation. This includes responsibilities for the issuing and regulation of nuclear site licences under the Nuclear Installations Act 1965 (as amended).
Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations 1999	These regulations require nuclear power station operators to obtain consent from the ONR prior to the commencement of decommissioning. This requires the submission of an Environmental Statement and Environmental Impact Assessment and a period of consultation.
Environmental Permitting (England and Wales) Regulations 2016	These regulations seek to ensure that permitted activities and their discharges do not endanger the environment or human health. Environmental Permits must be sought from NRW for both radioactive and conventional wastes and discharges. They combine the requirements for an integrated waste management approach and the requirements for hazardous waste management. They provide a framework for regulation that enables NRW and ONR (as well as other interested government or regulatory departments) to assess permitting and compliance with a common approach. These regulations apply to all wastes (radioactive and conventional), effluent treatment plants and generator boilers discharges.
Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009	This legislation incorporates the European Agreement concerning the International Carriage of Dangerous Goods by Road and the Regulations concerning the International Carriage of Dangerous Goods by Rail. It defines the requirements for the safe transportation of radioactive waste materials.

Table 2-2 Main national strategy, policies and guidance relevant to radioactive waste and spent fuel management

Policy/Guidance	Description
Long-term Nuclear Energy Strategy [RD2]	The UK Long-term Nuclear Energy Strategy lays out the Government's policy on the use of nuclear energy as part of a low carbon future, including through the construction of new nuclear facilities. As part of this strategy, the Government lays out key priorities for the sector, including the issue of both legacy nuclear wastes and the treatment of radioactive wastes from nuclear new build. This strategy builds upon the existing legislative requirements for new nuclear facilities to have a funded decommissioning programme in place prior to the granting of a nuclear site

Policy/Guidance	Description
	licence. The Government commitment includes the establishment of the ONR to regulate the sector. With regards to radioactive waste management, the strategy assumes that spent fuel and intermediate level waste (ILW) will be disposed of within the proposed national GDF once the facility becomes available.
UK Strategy for Radioactive Discharges [RD3]	This strategy describes how the UK will continue to implement the UK's obligations under the OSPAR Radioactive Substances Strategy objective for 2020 [RD4], namely for progressive and substantial reductions in radioactive discharges, radionuclide concentrations in the marine environment and human exposure to ionising radiations due to radioactive discharges.
The Review of Radioactive Waste Management Policy: Final Conclusions [RD5]	From this policy, the following key principles arise: • radioactive wastes should not be unnecessarily created; • such wastes as are created should be safely and appropriately managed and treated; and • wastes should be safely disposed of at appropriate times and in appropriate ways. These are underpinned by general requirements that: • radioactive wastes should be managed and disposed of in ways which protect the public, workforce and the environment; and • radioactive waste management should safeguard the interest of existing and future generations and the wider environment, and in a manner that commands public confidence and takes due account of costs. The review is amended and replaced in parts by the Policy for the Long-Term Management of Solid Low-Level Radioactive Waste in the United Kingdom, 2007 [RD6].
UK Strategy for the Management of Solid Low-Level Radioactive Waste from the Nuclear Industry [RD7]	The aim of this strategy is to provide a high level framework within which Low Level Waste (LLW) management decisions can be taken flexibly to ensure safe, environmentally acceptable and cost-effective management solutions that reflect the nature of the LLW concerned. There are three strategic themes: • the application of the waste hierarchy; • the best use of existing LLW management assets; and • the need for new, fit-for-purpose waste management routes for LLW. This strategy is subject to periodic review and an updated Strategy was issued in February 2016. The revised strategy is in line with the original version (for example based upon the waste hierarchy), whilst reflecting the changes to available options for the treatment of LLW since the issue of the original version.
The management of higher activity radioactive	Joint guidance from the ONR, NRW, the Environment Agency and the Scottish Environmental Protection Agency is provided to nuclear licensees in addressing higher activity wastes throughout their lifecycle. The production of

Policy/Guidance	Description
wastes on nuclear licensed sites [RD8]	a Radioactive Waste Management Case is recommended by the guidance. It also includes guidance on waste management, characterisation and segregation, condition and disposability, storage of radioactive waste and managing information and records relating to waste.
Industry Guidance: Interim Storage of Higher Activity Waste Packages – Integrated Approach [RD9]	NDA co-ordinated guidance. It is intended that the Guidance will be used by those involved in managing any aspect of current and future UK stores of packaged HAW. The guidance seeks to cover all the significant technical issues arising from interim storage of packaged HAW, to be practicable in implementation and relevant to all UK storage system designs. It is expected that operators will implement the guidance to maintain and improve existing waste storage systems and when planning new stores. Other organisations will continue to be able to freely access and use the guidance.
Isle of Anglesey County Council (IACC) New Nuclear Build at Wylfa Supplementary Planning Guidance [RD10]	The overarching purpose of this Supplementary Planning Guidance is to provide guidance on important local, direct and indirect matters. It sets out the IACC's vision and objectives regarding the Wylfa Newydd Project, for which it is the most up-to-date guidance available. It also aspires to: • inform the IACC's position in its Local Impact Report and subsequently the Statement of Common Ground (documents to be submitted to the Planning Inspectorate as part of Development Consent Order examination); • provide a planning framework to guide applicants and influence the Wylfa Newydd Project's design and development to ensure sustainable outcomes, with a focus on Associated Development; • inform Pre-Application Consultation for the Wylfa Newydd Development Area and Associated Development; and • offer supplementary local-level guidance consistent with the National Policy Statements; and form a material consideration in the assessment of the Wylfa Newydd Project elements that are subject to Town and Country Planning Act applications.
Funded Decommissioning Programme Guidance for New Nuclear Power Stations [RD11]	The Government legislated in the Energy Act 2008 to ensure that operators of new nuclear power stations have secure financing arrangements in place to meet the full costs of decommissioning and their full share of waste management and disposal costs. Before nuclear-related construction can begin on site, an operator of a new nuclear power station must have a FDP in place approved by the Secretary of State. This guidance sets out the principles the Secretary of State will expect to see satisfied in the FDP prepared by an operator. The Guidance gives information on ways in which an operator might satisfy those principles, thereby assisting operators in understanding their obligations under the Energy Act 2008.

Policy/Guidance	Description
Waste Transfer Pricing Methodology [RD12]	The purpose of the Waste Transfer Pricing Methodology is to set out how the waste transfer price will be determined. This methodology will form the basis of more detailed provisions to be set out in the waste contract that will be agreed between the government and the operator. It is intended to ensure that the entire costs of disposal now and in the future are met by the operator.
Managing Radioactive Waste Safely [RD13]	A white paper that sets out the UK Government's framework for managing higher activity radioactive waste in the long term through geological disposal, coupled with safe and secure interim storage and ongoing research and development to support its optimised implementation.
National Policy Statements (NPS) Energy EN-1 2011 [RD14].	This National Policy Statement, designated by the Secretary of State in July 2011, sets out the overarching national policy for delivery of major energy infrastructure projects. This forms the primary policy context for a decision on Horizon's application for a Development Consent Order for the Power Station.
NPS Nuclear Power Generation EN-6 2011 [RD15].	The National Policy Statement designated by the Secretary of State in July 2011 that sets out national policy on new nuclear power stations identified as potentially suitable for deployment by 2025, and provides specific considerations with regard to radioactive waste (which are set out in section 2.11 and annex B of the NPS). This also forms the primary policy context for a decision on Horizon's application for a Development Consent Order for the Power Station. EN-6 recognises that "The UK has robust legislative and regulatory systems in place for the management (including interim storage, disposal and transport) of all forms of radioactive waste that will be produced by new nuclear power stations." "As the licensing and permitting of nuclear power stations by the nuclear regulators is a separate regulatory process, the Examining Authority for the DCO should act on the basis that: • the relevant licensing and permitting regimes will be properly applied and enforced; and • it should not duplicate the consideration of matters that are within the remit of the nuclear regulators." In relation to long-term radioactive waste management, Annex B of EN-6 sets out that other facilities for the interim storage of waste may come forward. "*However, in the absence of any proposal the IPC should expect that waste would be on site until the availability of a geological disposal facility*".
Guidance on International Safeguards and Nuclear Material	The guidance includes nuclear material accountancy and safeguards best practice for the life of a nuclear plant from design to decommissioning. This regulation details safeguards reporting requirements for nuclear materials

Policy/Guidance	Description
Accountancy at Nuclear sites in the UK [RD16]	and implements Commission Regulation (Euratom) 302/2005 which details safeguards reporting requirements for nuclear materials.

2.5 Horizon's radioactive waste management principles

Nuclear, safety, security and environmental principles

2.5.2 The UK nuclear regulatory approach is underpinned by national nuclear, safety, security and environmental principles, which, among other things, provide the framework for how environmental effects are reduced (see chapter B14 Radiological effects, Application Reference Number: 6.2.14). These take due consideration of the objectives and principles published by the regulators (ONR and NRW) and are intrinsic to Horizon's approach to waste management.

Design principles

2.5.3 Principles relevant to the management of waste are summarised in table 2-3. The following criteria are being taken into account in the design stage of the UK ABWR to reduce construction wastes, radioactive wastes and facilitate the later decommissioning of the plant (as required by the demonstration of BAT for the Environmental Permit).

Table 2-3 Design principles for waste management

Principle	Description
Application of BAT and ALARP	These are the fundamental underpinning philosophies on which all decision making relating to management of all wastes (solid, liquid and gaseous, conventional and radioactive) will be based. They are intended to ensure that potential risk to people and the environment is minimised so far as is reasonably practicable throughout the entire lifecycle of the power station. The BAT and ALARP methodologies will be applied proportionately based on the extent of the hazard.
Application of the Waste Hierarchy	Horizon will implement the waste hierarchy to ensure that optimisation of wastes is achieved so far as is reasonably practicable throughout the entire lifecycle of the Power Station.
Application of Waste Minimisation	Wherever reasonably practicable the generation of waste is to be avoided and if unavoidable the quantity of waste generated is to be kept to levels that are as low as reasonably achievable.
Waste Identification and Characterisation	In order to demonstrate robust control over the management of wastes it is essential that all potential waste sources are identified and assessed to provide sufficient definition on waste characteristics to enable the selection of appropriate management and disposition strategies.

Principle	Description
Segregation of Waste at Source	To maximise the effectiveness of disposition routes it is essential that wastes are segregated as close to the source of arising as possible, and that risks of downstream cross-contamination are mitigated through appropriate separation of waste routes.
Holistic Waste Strategy Development	Wastes should be considered holistically throughout their entire lifecycle from production to disposition and options for their management should be based on this holistic consideration.
Waste Process Optimisation	Waste disposition options should be identified through a rigorous process of options identification, assessment and selection. In considering options all relevant factors including safety, environmental impact, cost, time and difficulty should be taken into account.
Passive Safe Storage	Where appropriate, wastes will be processed into a passively safe state as soon as is reasonably practicable, and stored in accordance with relevant good practice.
Waste Led Approach	Specific requirements associated with discrete disposition routes are provided by the operators of the downstream waste management facilities. These are generally expressed as Waste Acceptance Criteria (WAC) or Conditions for Acceptance. Horizon will in turn produce compliance criteria associated with on-site waste management processes which waste producers will be required to comply with.
Proximity Principle	Wherever reasonably practicable Horizon will utilise the proximity principle when sending waste and materials off-site, both to minimise the environmental impact of transporting wastes over long distances, and as part of corporate social responsibilities to engage with and promote the use of local facilities and services.
Application of Relevant Good Practice	Horizon will identify and apply relevant good practice through engagement with subject matter experts, identification of relevant industry guidance and interaction with other industry bodies.
Stakeholder Engagement	Early and ongoing engagement with relevant stakeholders will be undertaken to ensure that a holistic and compliant set of waste management processes are defined and implemented.
Waste Records and Traceability	As part of an overarching ‘waste management system’ waste records will be produced, managed and stored under appropriate quality management arrangements.

3 Introduction to radioactive waste and spent fuel

3.1 Introduction

3.1.1 This section briefly describes the sources of radioactive waste at the Power Station, the permitted discharge routes, and gives a description of the UK classification of solid radioactive waste by activity levels. In addition, a brief discussion is provided of the status of spent fuel in a UK context. Project specific details are given in later sections. The regulation of these wastes will be covered as part of the nuclear licensing and permitting activities.

3.2 Radioactive waste

3.2.1 Radioactive waste would be generated during the operation of the Power Station, primarily due to nuclear fission of the fuel, activation of impurities in the reactor water and activation of corrosion products in the reactor circuit.

3.2.2 Waste processing systems would be in place to treat radioactive waste materials arising during operation and decommissioning of the Power Station, in order to reduce the activity of radioactive waste that is subsequently released to the environment such that it meets the conditions set out in the Environmental Permit as further discussed in section 5.

3.2.3 The waste that is ultimately disposed of to the environment can be broadly grouped into three streams:

- gaseous waste discharged via stacks on the reactor buildings and other permitted outlets;
- liquid waste discharged via the liquid effluent discharge outlet; and
- solid waste that is treated and disposed of at permitted off-site facilities (this includes some wet solid waste, such as resins and sludges, which would be processed and disposed of as solid waste).

3.3 Solid radioactive waste classification

3.3.1 The management of solid radioactive waste depends, among other things, on its radioactivity level. In the UK, radioactive wastes are classified in terms of the nature and quantity of radioactivity they contain and the heat they produce. The categories are broadly divided into higher activity radioactive waste (HAW) and lower activity radioactive waste (LAW) as below.

HAW

- High Level Radioactive Waste (HLW): waste that is sufficiently radioactive for its decay heat to significantly increase its temperature and the temperature of its surroundings, such that heat generation has to be taken into account in the design of storage and disposal facilities.

- Intermediate Level Radioactive Waste (ILW): wastes exceeding the upper boundaries for LLW but that do not require heat generation to be taken into account in the design of storage or disposal facilities.
- The HAW definition also includes for any LAW that does not conform to disposal requirements and therefore has to be managed as HAW (note for the Wylfa Newydd Project, no LAW of this type has been identified).

LAW

- Low Level Radioactive Waste (LLW): waste that has a radioactive content not exceeding 4GBq (giga becquerels) per tonne of alpha activity, or 12GBq per tonne of beta/gamma activity.
- Very Low Level Radioactive Waste (VLLW): VLLW is a sub-set of LLW with lower levels of radioactivity which enables its disposal to specific landfill sites that hold appropriate Environmental Permits.

3.3.2 There is no currently available UK disposal facility for HAW and therefore it is required to be managed on-site in the interim. The design incorporates facilities and capabilities to manage the production, processing and storage of HAW.

3.3.3 LAW would be transported from site to treatment and/or disposal facilities that hold appropriate Environmental Permits. The wastes would generally be removed from site shortly after being produced and therefore on-site storage is limited to the collation of transportable quantities of waste, with some in-built contingency should any off-site route be temporarily unavailable. The design incorporates facilities and capabilities to manage the production, processing and buffer storage of LAW.

3.4 Spent fuel

3.4.1 To maintain reactor generating efficiency, fuel elements are replaced in the reactor core every few years. The removed assemblies of spent fuel are placed in the spent fuel pool until they have cooled sufficiently for transfer to the spent fuel storage facility.

3.4.2 The 2016 UK Radioactive Waste Inventory [RD17] describes spent fuel as follows:
"*Nuclear fuel that is being or has been used to power nuclear reactors is referred to as 'irradiated'. When it has reached the end of its life and is no longer capable of efficient fission, it is known as 'spent fuel'. Spent fuel still contains large amounts of uranium (and some plutonium), which can be separated out by reprocessing and used to make new fuel*".

3.4.3 In the absence of a commercially available reprocessing facility, UK policy is for spent fuel to be stored pending disposal to a future national GDF. Horizon's strategy is to store the spent fuel on-site until the GDF is made available. At this point the spent fuel will be repackaged into a disposable form,

and having declared Horizon's intent to dispose of it, the spent fuel will then be termed waste in accordance with the EC Waste Framework Directive definition of waste and subsequently managed as HLW.

4 Radioactive waste during construction

4.1.1 Radioactive sources would be used to support geophysics and radiography during construction of the Power Station. There is a legal requirement under the Ionising Radiation Regulations 2017 for Horizon to have procedures in place to control the use of radioactive sources.

4.1.2 No other radioactive material would be used during construction. There is therefore no potential for radioactive waste to be generated during construction of the Power Station.

4.1.3 It is not anticipated that residual radioactive materials from the Existing Power Station would be encountered in soils and sediments excavated during clearance and excavation activities, beyond those already reported in routine monitoring programmes.

4.1.4 A rock and soil sampling survey across the Power Station Site found concentrations of naturally occurring radionuclides typical of natural soils and rock. There was no evidence of elevated radionuclide concentrations above typical background for north Wales [RD18].

4.1.5 Measurements of radioactivity in marine rock and sediment samples taken from the proposed location of the Marine Off-Loading Facility [RD19] show low levels similar to those observed in the routine monitoring programme around the Existing Power Station [RD20].

4.1.6 There is therefore no evidence of existing in-ground contamination arising from the Existing Power Station. However, the risk of future contamination from the Existing Power Station (either in soil or via migration of groundwater) will continue to be assessed.

4.1.7 The discovery of radioactive contamination would be managed in accordance with the controls defined in the Wylfa Newydd Code of Construction Practice (Application Reference Number: 8.6).

5 Radioactive waste streams and proposed management during operation

5.1 Introduction

5.1.1 This section discusses the proposed management of radioactive waste types in turn.

5.2 Gaseous radioactive waste

5.2.1 Radioactive gaseous and particulate emissions would be generated during the operation of the Power Station. These gaseous emissions would originate as the result of the following:

- activation of entrained atmospheric air in coolant;
- fission products from fuel; and
- thermal neutron irradiation of reactor water.

5.2.2 Under normal operating conditions and expected abnormal situations, there are two systems for the control, treatment and monitoring of aerial discharges:

- the Off-gas (OG) system for each reactor; and
- the heating, ventilation and air conditioning system (HVAC).

5.2.3 The OG system would reduce and control the release of the entrained radioactive gaseous emissions to the atmosphere by providing for hold-up (via cooler-condensers and activated charcoal adsorbers) and the resulting radioactive decay of gases. Entrained particulate material is filtered before discharge via the main reactor stack using High Efficiency Particulate in Air (HEPA) filters.

5.2.4 The key environmental function of the HVAC system is to limit the spread of radioactive materials from contaminated plant and equipment by filtering contaminated air, prior to its discharge to atmosphere, using HEPA filters. The HVAC system would comprise independent sub-systems serving separate areas of the Power Station. Of these areas, the reactor area, the turbine area and the controlled area inside the radioactive waste building would be the three main areas with the potential to generate radioactive gaseous emissions, and all three of these systems would discharge to atmosphere via the main reactor stack. The service building and lower activity waste management facility would have separate discharge points but the generation of gaseous radioactive waste would be negligible.

5.2.5 The HVAC system would generate solid LAW in the form of used HEPA filters that would be managed as LAW through the LAW management facility (see table 5-2).

Gaseous emissions monitoring

5.2.6 The filtration system and sampling and monitoring equipment would be in line with relevant nuclear industry code of practice and guidance (for example [RD21]).

5.2.7 The inlet and outlet of the OG charcoal absorber, as well as the turbine gland steam OG system and the mechanical vacuum pump exhaust, would be monitored using a radiation detector that continuously measures the gross radiation level of the OG. The measured radiation level would be indicated and recorded in the main control room. If the system detects a high radiation level, it would activate an alarm in the main control room and appropriate action taken, as defined in local operating instructions. The radiation level of the HVAC exhaust would not be monitored continuously because the activity discharged would be very low compared with the OG and turbine gland steam OG systems. The sampling and monitoring design of these facilities will be developed during Horizon's detailed design process.

5.2.8 Sampling and monitoring systems are expected to run at all times, measuring gaseous discharges from the main stack. These systems would sample and measure discharge flow, sampling flow, radioactivity, radioactive noble gases, tritium and carbon-14.

5.2.9 Chapter D14 (Application Reference Number: 6.4.14) provides a summary of the controls of radioactive gaseous and particulate emissions being considered, the discharged radioactivity and the assessment of potential effects on human receptors and the environment.

5.3 Liquid radioactive effluents and waste

5.3.1 The design of the radioactive contaminated liquid effluent systems is ongoing and will continue to be developed through the Power Station design.

5.3.2 The reactor cooling circuit and fuel pool (i.e. the plant areas containing water that comes into direct contact with irradiated fuel elements) would be operated as far as is practicable as closed loop systems in the turbine building and the reactor building. Water would be treated for reuse in the following three systems:

- condensate water clean-up system in the turbine building;
- reactor clean-up water system in the reactor building; and
- fuel pool clean-up system and suppression pool clean-up system in the reactor building.

5.3.3 Periodically, discharges from these systems would be transferred to the liquid effluent management system for treatment.

5.3.4 The liquid effluent management system would consist of the following systems, all located within the shared radioactive waste building that services both reactor Units:

- Low Chemical Impurity Waste (LCW) treatment system;

- High Chemical Impurity Waste (HCW) treatment system; and
- the controlled area drain.

5.3.5 The LCW and HCW systems would be used to treat radioactively contaminated effluent. Radioactive liquid effluents would be treated and re-used where practicable. On occasion, it would be necessary to discharge excess liquid effluent from the HCW system which cannot be reused due to water balance in the Power Station.

5.3.6 The LCW system is designed to allow the efficient treatment of relatively large volumes of effluent containing low levels of both insoluble and soluble impurities. Cartridge filters would be used to remove the insoluble impurities. The filtered water would then pass through a mixed bed demineraliser packed with bead ion exchange resins to remove soluble impurities. The treated effluent would then be returned to the condensate storage tank for re-use in the reactor, if it meets the appropriate criteria. If the criteria are not met, the effluent could be recirculated through the system for further treatment.

5.3.7 The HCW system is designed for treatment of effluent containing higher levels of both insoluble and soluble impurities. The effluent received by the HCW system would first be subjected to evaporation. The distillate would then pass through a mixed bed demineraliser packed with bead ion exchange resin to remove any soluble contaminants that could potentially be carried over from the evaporator. Following sampling and monitoring, treated effluent would either be transferred to the condensate storage tank for reuse or, in the event that the effluent volumes exceed the available capacity in the condensate storage tank, discharged to the environment via the Cooling Water System outfall. Prior to discharge, the treated effluent would be sampled to ensure that residual levels of radioactive and chemical contamination are within the discharge limits and conditions in the Environmental Permit.

5.3.8 The controlled area drain system would collect the effluent from notionally uncontaminated systems in controlled areas, such as the local air conditioning systems. Effluent is collected in the controlled area drain collection tanks and sampled. If the effluent meets the discharge criteria, it would be discharged via the Cooling Water System outfall. If effluent requires further treatment prior to discharge to the environment, it would be routed to the HCW system.

5.3.9 Liquid effluent treatment systems would produce dry-solid LAW, wet-solid LLW and wet-solid ILW, the management of which is described in the solid radioactive waste section in table 5-1, table 5-2 and table 5-3.

Liquid effluent monitoring

5.3.10 The overall liquid effluent management system (LCW, HCW and the controlled area drain) would incorporate monitoring systems for all of the main process parameters (pressure, flow, temperature, tank levels, etc.) with appropriate alarms provided to the operators in the event of abnormal conditions.

5.3.11 Prior to discharge to the environment, a representative sample of the liquid effluent from the HCW and the controlled area drain systems would be

analysed to confirm it met the discharge criteria. If the liquid effluent did not meet the discharge criteria, it would be redirected back to the liquid effluent management system for additional treatment.

5.3.12 Samples would also be collected from the final discharge line using a flow proportional sampler. At the sample location the flow of the discharge would also be measured. Redundancy for discharge sampling would be provided in the form of duplicate flow measurement apparatus along with a second flow proportional sampler.

5.3.13 In addition to the sample collection, a continuous radiation monitor would be provided in the liquid discharge line. If the system detected a high radiation level, the monitor would activate an alarm and close an isolation valve to stop the discharge to the environment.

5.3.14 Chapter D14 (Application Reference Number: 6.4.14) provides a summary of the controls of radioactive liquid effluents being considered, the discharged radioactivity and the assessment of potential effects on human receptors and the environment.

5.4 Solid radioactive waste

5.4.1 Operation of the Power Station would result in the generation of the following types of solid radioactive wastes (see paragraph 3.3.1 for definitions of waste categories):

- wet-solid LLW;
- dry-solid LAW;
- wet-solid ILW; and
- dry-solid HLW.

5.4.2 Tables 5-1 to table 5-4 describe the radioactive wastes by type and include descriptions, anticipated volumes and the proposed waste management strategy to handle and manage each waste type and the facilities required. The tables provide additional information on the nature and quantity of individual radioactive wastes streams anticipated to arise from the operation of two UK ABWRs at the Power Station over a 60-year operational life. The waste quantities are derived from information presented in the GDA for the UK ABWR amended to reflect a two Unit site. The estimates provided are based on a conservative assessment of the waste-generating processes and will undergo further refinement and optimisation as the site-specific design progresses.

5.4.3 The approach to the management of spent fuel is described in table 5-5.

Management of LAW generated during operation

5.4.4 The following two tables set out details regarding the proposed management of LAW generated during operation. There are anticipated to be14 third-height ISO containers of cement-encapsulated, wet, solid LLW, as well as nine half-height ISO containers and six full-height ISO containers of dry, solid LLW and

VLLW disposed of per year, with different destinations depending on disposal route. Estimates of LLW and VLLW transports are very conservative at this stage of design development.

Table 5-1 Wet-solid LLW

Wet-solid LLW	
Category description	LLW – waste that has a radioactive content not exceeding 4GBq per tonne of alpha activity or 12GBq per tonne of beta/gamma activity.
Typical sources	Wet-solid LLW would arise from the HCW and LCW systems and the condensate demineraliser system. The treatment systems would use evaporation, ion-exchange and/or filtration, and the following wet-solid LLW streams would be produced: • spent bead resins generated from the demineralisers; and • concentrates from the evaporator.
Annual volumes	Annual operational volumes arising of wet-solid LLW for the two Units is expected to be approximately: • 23m^3 per year of bead resins; and • 2m^3 per year of concentrates.
Management strategy	Placed in buffer storage tanks in the radioactive waste building. Transferred to the wet solid LLW processing system, to be packaged by cement immobilisation. Processed in campaigns. Transported to the LLWR, near Drigg in Cumbria.
Power Station Site facilities	Buffer storage tanks in radioactive waste building. Additional mobile processing equipment provided by the supply chain (required approximately 10 years after the start of operations).
External facilities	LLWR

Table 5-2 Dry-solid LAW

Dry-solid LAW	
Category description	VLLW – waste for bulk disposal that has a radioactive content not exceeding 4MBq per tonne of total activity (40MBq per tonne for tritium). LLW – waste that has a radioactive content not exceeding 4GBq per tonne of alpha activity or 12GBq per tonne of beta/gamma activity.
Typical sources	Dry-solid LLW (including VLLW) is generated through routine operation, maintenance and decommissioning. This waste stream consists of the following items: • HEPA filters used to abate airborne particulates in HVAC systems in controlled contamination areas in the reactor, turbine, radioactive waste and service buildings as well as waste treatment facilities; • cartridge filters used to remove insoluble impurities in the LCW and condensate filter system; and • heterogeneous LLW anticipated to arise as a result of operation and maintenance activities. Wastes will include metals, organic plastics, paper, card, wood, glass, building materials, insulation, motors, cables and pipes, miscellaneous filters and strainers.

Dry-solid LAW	
Annual volumes	Annual operational volumes arising of dry-solid LAW) for the two Units is expected to be approximately: • HVAC filters 47m^3; • cartridge filters 4.5m^3; and • heterogeneous LAW 112m^3.
Management strategy	HVAC filters: Filters will be removed, packaged and transferred to the LAW management facility where they will be loaded into suitable transport containers for transfer to an appropriately permitted off-site supercompaction or incineration facility. The resultant waste will be packaged for transfer and disposal at LLWR. Cartridge filters: On removal, the filter module is loaded into suitable containers. These will be transferred to the LAW management facility, where they will be consigned to appropriately permitted off-site supercompaction or incineration facilities. If the filters do not meet the WAC for these facilities, they will be transferred to the LLWR for direct disposal. Heterogeneous LLW: Sorting, segregation and characterisation at source to comply with the waste acceptance criteria; and where practicable, wastes would be recycled (via metal melting), volume reduced (compaction and/or incineration) or disposed of directly to the LLWR or permitted VLLW landfill.
Power Station Site facilities	Lower activity waste management facility.
External facilities	LLW direct disposal locations: • LLWR in Cumbria. LLW recycling (metal melting) services: • Cyclife (formally Studsvik) Metal Recycling Facility, Workington, Cumbria; and • Tradebe Inutec, Winfrith, Dorset. LLW incineration locations: • Tradebe, Fawley, Fawley Thermal Treatment Centre, Southampton; • Augean Treatment Ltd, Kent High Temperature Incinerator, Sandwich, Kent; • Grundon, Colnbrook, Berkshire; and • Veolia, Ellesmere Port, Cheshire. LLW supercompaction locations: • Tradebe Inutec, Winfrith, Dorset. VLLW direct disposal locations: • Augean, East Northants Resource Management Facility, Northamptonshire; • Sita, Clifton Marsh Landfill Site, Lancashire; and • FCC Environment, Lillyhall Landfill Site, Cumbria. It is currently assumed that the proposed transport route to these facilities would be by road using approved radioactive waste transport containers.

Management of ILW generated during operation

5.4.5 The following table sets out the details regarding the proposed management of ILW generated during operation.

Table 5-3 Wet-solid ILW

Wet-solid ILW	
Category description	ILW - waste that has a radioactive content exceeding the LLW limit and that does not have a significant heat output.
Typical sources	Wet-solid ILW arises from the reactor water clean-up system, fuel pool clean-up system, the backwashing of filters in the condensate filter system and the LCW system. The following wet solid ILW streams are produced: • sludge from backwashing filters; and • powder resins from filter demineralisers.
Annual volumes	Annual operational volumes arising of wet-solid ILW is expected to be approximately: • 3.0m^3 per year of sludge; and • 8.8m^3 per year of powder resins.
Management strategy	Store in buffer storage tanks in the radioactive waste building. Transfer to the wet solid ILW processing system, where it would be packaged by cement immobilisation in 3m^3 stainless steel drums (expected arisings indicate the wet solid ILW processing system is not required until approximately ten years after commencement of operations). The drums would then be transferred to the ILW storage facility, which can store all of the ILW generated during operation of the Power Station. Transferred for final disposal to the GDF.
Power Station Site facilities	Buffer storage tanks in radioactive waste building. Wet solid ILW processing system in the radioactive waste building (required approximately ten years after the start of operations). ILW storage facility (required approximately ten years after the start of operations).
External facilities	The current assumption is that the GDF would not be available to receive ILW from the Power Station until after completion of the Power Station Site decommissioning phase.

Management of HLW generated during operation

5.4.6 The following table sets out the details regarding the proposed management of HLW generated during operation.

Table 5-4 Dry-solid HLW

Dry-solid HLW	
Category description	HLW - waste that has a radioactive content exceeding the LLW limit and has a significant heat output. Note: Although the HLW generated at the Power Station would be heat-generating immediately upon removal from the reactor, it would be decay-cooled such that it could be managed as ILW at the point of disposal.

Dry-solid HLW	
Typical sources	This waste stream predominately consists of the following: • controls rods; and • reactor components including monitors, probes; and neutron sources.
Annual arisings	Annual operational arisings of dry solid HLW for the two Units is expected to be approximately 2,640 kg/yr.
Management strategy	Stored in the spent fuel pool for approximately 10 years. Packaged into stainless steel canisters and transfer overpacks prior to transfer to the spent fuel storage facility. In the spent fuel storage facility, transfer of canisters from the transfer overpacks to the storage overpacks. Prior to final disposal, repackaged into 3m^3 stainless steel boxes. Final transportation and disposal to the GDF.
Power Station Site facilities	Spent fuel pool. Spent fuel storage facility (required approximately ten years after the start of operations). Cask preparation area (required approximately ten years after the start of operations). Cask transporter garage (required approximately ten years after the start of operations). Repackaging facility to inspect the HLW when the spent fuel pool is no longer available and to provide repackaging capability (only required after completion of the main power plant site decommissioning phase). Decommissioning ILW storage facility to store repackaged decayed HLW and decommissioning ILW arisings (only required after completion of the main power plant site decommissioning phase).
External facilities	The current assumption is that the GDF would not be available to receive ILW from the Power Station until after completion of the Power Station Site decommissioning phase.

5.5 Spent fuel

5.5.1 The following table sets out the details regarding the proposed management of spent fuel generated during operation.

Table 5-5 Spent fuel

Spent fuel	
Category description	Spent fuel is fuel that has been used in a nuclear reactor (fuel assemblies consist of 92 fuel rods containing uranium dioxide fuel pellets, which are stacked in a cladding tube, plugged and seal welded).
Typical sources	Spent fuel would be generated by the two UK ABWRs at the Power Station.
Annual arisings	It is anticipated that the total number of fuel assemblies discharged over 60 years of operation is 9600 per reactor, which gives an annual average arising of 320 assemblies for the Power Station.
Management strategy	Replacement of spent fuel:

Spent fuel	
	• Approximately 224 complete fuel assemblies would be replaced per Unit every outage; • there would be an outage every 18 months for each Unit; and • this is an assumed operational regime that may change during the life of the reactor, and as such, the number of spent fuel assemblies is subject to change during the operational phase. Spent fuel pool: • spent fuel assemblies would be stored in the spent fuel pool for approximately 10 years; • the spent fuel assemblies would be put into stainless steel canisters and transfer overpacks. The stainless steel canisters and overpacks, combined, are referred to as 'casks'; and • the assumption is that each spent fuel cask takes 68 fuel assemblies. Spent fuel storage facility: • the spent fuel cask would be transported to the spent fuel storage facility; • the spent fuel canisters would be transferred from the transfer overpacks to the storage overpacks within the spent fuel storage facility; • the spent fuel storage facility would be designed to accomodate the entire spent fuel and HLW arisings over the lifetime of the Power Station; and • the spent fuel storage facility would be required approximately 10 years after the start of operation of reactor Unit 1. GDF: • prior to disposal to the GDF, the spent fuel would require repackaging into a suitable disposal container, as specified by the GDF operator.
Power Station Site facilities	Spent fuel pool. Spent fuel storage facility (required approximately ten years after the start of operations). Cask preparation area (required approximately ten years after the start of operations). Cask transporter garage (required approximately ten years after the start of operations). Repackaging facility to inspect the spent fuel when the spent fuel pool is no longer available and to provide repackaging capability prior to spent fuel disposal (only required after completion of the main power plant site decommissioning phase).
External facilities	There is current uncertainty when the GDF would be available to receive spent fuel from the Power Station. The storage facilities will be designed to be safely operated and maintained for up to 140 years from end of generation (although this is a worst case and is expected to be reduced to less than 75 years after the end of generation).

6 Radioactive waste and proposed management during decommissioning

6.1.1 Horizon is developing a decommissioning strategy which outlines the approach to be taken in decommissioning the Power Station, with all waste arising (including the radioactive waste) from this process treated using the same overall approaches as for operation. At this early stage, the NDA bodies responsible for the GDF and LLWR have been consulted to ensure that the envisaged radioactive wastes would be able to be disposed of in line with current practices.

6.1.2 The decommissioning strategy will use Horizon's nuclear, safety and environmental principles to provide a framework for how wastes would be handled and managed in order to reduce environmental effects. It will also set out plans to ensure compliance with legislative requirements and to clarify how Horizon will work with the relevant parties.

6.1.3 Horizon has considered a number of high-level strategy options for decommissioning based on the Power Station Site configuration, the key project timing assumptions and various other factors. The conclusion is that a prompt decommissioning strategy is preferred which aims to start the decommissioning of the Power Station Site as soon as is practicable after the end of generation. The strategy is currently estimated to remove the power plant buildings within 20 years of end of generation. As part of the decommissioning process, the following actions would be carried out within the first 20 years:

- final de-fuelling of the reactor Units;
- removal of all materials used in operational plant, systems and facilities;
- treatment and disposal of radioactive and hazardous materials;
- demolition of buildings and structures; and
- nuclear licenced site boundary will be reduced to encompass the remaining facilities, including the spent fuel storage facility, ILW storage facilities for operational and decommissioning wastes and the repackaging facility.

6.1.4 Spent fuel will remain on site in the spent fuel storage facility until the GDF is available (between 75 and 140 years after the end of generation). The following actions would then be required:

- repackaging of spent fuel prior to disposal;
- transfer of stored ILW and spent fuel to the GDF; and
- the final step is for the remainder of the nuclear licenced site to be de-licenced, which will allow alternative use for the land.

6.1.5 These activities may continue to require permitted discharges of radioactivity to air and sea, and the waste stores would be a source of direct radiation.

Small direct radiation doses would also result from the transport of waste material away from the site to authorised disposal sites.

6.1.6 Horizon currently estimates that the following approximate waste quantities would arise from decommissioning activities (see table 6-1). Preliminary waste quantification information is also presented in chapters 4 and 5 of EP-RSR permit application [RD22].

Table 6-1 Estimates of decommissioning waste arisings

Waste type	Waste source	Estimated total waste quantities
Primary Decommissioning LAW	LLW/VLLW from de-planting operations, post-operational clean out, scabbling etc.	18,000 tonnes
Secondary Decommissioning LAW	LLW/VLLW filters, used equipment, personal protective equipment, decontamination resins etc.	8,500 tonnes
Primary Decommissioning ILW	ILW activated materials, segmentation of reactor pressure vessel and reactor internals, control rods etc.	4,000m^3
Secondary Decommissioning ILW	ILW decontamination resins, cutting abrasives etc.	250m^3

7 Availability of LAW treatment and disposal facilities

7.1.1 The operational period of the UK ABWRs is assumed to be 60 years. A prompt decommissioning strategy would aim to remove the power plant buildings within 20 years of the end of generation. However, the operation and decommissioning of the ILW storage facility and spent fuel storage facility would extend several decades beyond that. The production of LAW would continue throughout the operational and decommissioning periods.

7.1.2 The envisaged processing and disposal routes for LAW during operation and decommissioning, will conform to the application of the waste management hierarchy and include:

- metals treatment and recycling;
- volume reduction by incineration;
- volume reduction by high force compaction;
- disposal to permitted landfill (VLLW); and
- disposal to LLWR (LLW).

7.1.3 Extensive facilities for the treatment and disposal of LAW currently exist in the UK and overseas and there is a robust and mature national waste programme (NWP) that oversees the provision of the required capabilities. The services for treatment and disposal are provided either directly with the supply chain or through a Waste Services Contract administered by the LLWR operator, LLWR Ltd.

7.1.4 Horizon strategy for the management of LAW is predicated on the national arrangement described above. LAW from the power station would be despatched off-site for treatment and disposal as soon as reasonably practicable after it was generated.

7.1.5 A key thread of national strategy is to ensure that LAW is suitably segregated at source to maximise the application of the waste hierarchy and thereby minimise the amounts of wastes that are sent for disposal. In this way Horizon would contribute towards one of the key objectives of the NWP which is to make the best use of existing national waste management assets, namely LLWR waste disposal capacity.

7.1.6 It is recognised that in the planned timescales for construction, commissioning and operation of the Power Station there may be technological developments in the field of radioactive waste processing and disposal that could improve on the current strategies. Horizon is therefore maintaining ongoing dialogue with the relevant stakeholders to ensure that proposed approaches remain demonstrably BAT, or could be adjusted to reflect the state of the art.

7.1.7 The continued availability of disposal facilities for LAW is stated in the UK Government policy for the long-term management of solid LLW in the UK [RD6]. It is therefore assumed that new and similar disposal facilities would

be provided after existing facilities, such as the LLWR, have ceased to accept waste, and would have the capacity for the direct disposal of LAW.

7.1.8 The NDA are responsible for implementation of the UK LLW policy and undertake consultation with consignors and suppliers via engagement with the NWP. Horizon will continue to engage with the NWP to ensure disposal routes are optimised.

7.1.9 Horizon would continue to explore alternative disposal routes and strategies, to ensure that the best use was made of existing UK LAW management facilities. If LAW disposal facilities are not available to receive waste, LAW would be stored on-site until a suitable disposal route is available. The storage of this waste would require a variation to the envisaged Environmental Permit, in addition to being regulated by the ONR, through the conditions of the nuclear site licence and in consultation with NRW.

8 Availability of the Geological Disposal Facility

8.1.1 The UK Government white paper 'Meeting the Energy Challenge' [RD23] states that new nuclear power stations should proceed on the basis that spent fuel will not be reprocessed. As such, spent fuel should instead be disposed of to the GDF.

8.1.2 At present there is no national disposal facility for HAW and spent fuel. A GDF is planned for the disposal of spent fuel and HAW but this would not be available until 2040 at the earliest. Once available there would be a phased transfer of packaged waste from existing sites before Horizon would be able to access this facility for disposal of HAW and spent fuel. There is therefore a requirement to manage HAW and spent fuel on site in the intervening period. As stated in paragraph 3.4.3, Horizon's strategy is to store the spent fuel until the GDF is made available. The storage facilities would be sufficient to accommodate arisings from a 60-year operational lifespan, until a GDF is available.

8.1.3 The current conservative estimate of the timescale for which spent fuel storage would be required on the Power Station Site is for a maximum of 140 years after the end of generation. However, work is currently on-going to optimise this and to produce a more accurate estimate of the storage duration. Early work suggests that a period of 70 to 80 years after the end of generation may be a more realistic estimate.

8.1.4 Timescales for spent fuel will also be dependent on the characteristics of the host rock of the future GDF, for example higher strength rock or lower strength rock. The characteristics of the host rock will determine the acceptable levels of thermal heat output from waste packages consigned for disposal and therefore, will determine the required length of on-site storage required to 'cool' the spent fuel prior to disposal.

8.1.5 The timescales for which ILW storage would be required on the Power Station Site are expected to be significantly shorter than those associated with spent fuel. The current assumption based on the availability of the GDF is that ILW disposal will commence in 2130, approximately 45 years after the end of generation.

8.1.6 On-site storage periods for ILW are comparable with other decommissioning projects currently on-going, since the availability of a GDF is also fundamental to the completion of those projects, as well as the use of 'Care and maintenance' periods in the decommissioning plan (for example [RD24]). The storage facilities would be designed to be safely operated and maintained for this period.

9 Conclusions

9.1.1 Radioactive waste and spent fuel would be generated during the operation and decommissioning of the Power Station and would be processed and stored under strict controls prior to disposal. No radioactive waste would be generated during the construction phase.

9.1.2 There are pre-existing UK legislative processes that Horizon must follow and nuclear regulators and technical authorities that Horizon works with regarding the management of radioactive wastes. Horizon will ensure that a consistent and safe approach is adopted for making decisions on waste management for the Power Station. Horizon will ensure that environmental protection legislation for all waste types is complied with.

9.1.3 The fundamentals of managing radioactive waste are to ensure that the amount of waste is minimised and is then disposed of via the most appropriate route. Wherever reasonably practicable, measures will be taken to prevent materials either becoming radioactively contaminated or activated, or as being classified as radioactively contaminated due to the inadvertent placement of inert material adjacent to radioactive material. Recycling and re-use will be applied wherever reasonably practicable.

9.1.4 In order to maximise the effectiveness of decisions made on waste consignment, it is imperative that wastes are accurately characterised as soon as possible following generation and segregated effectively to optimise subsequent waste treatment processes. Mixing or cross-contamination of wastes would be avoided wherever reasonably practicable and wastes would generally be reduced to the lowest achievable classification. All of these considerations would be taken into account when considering handling, treatment and disposal of radioactive waste.

9.1.5 Horizon has developed a management strategy to provide confidence that there are clear systems and procedures in place for ensuring that the radioactive waste and spent fuel would be handled and processed in a safe manner and in compliance with UK legislation.

9.1.6 There will be waste processing systems in place to treat radioactive effluents and gaseous emissions, in order to reduce the activity and volume of discharges to as low as reasonably achievable whilst also ensuring they are below permitted levels prior to discharge. Potential effects are summarised as part of the assessments in chapter D14 (Application Reference Number: 6.4.14).

9.1.7 Any solid radioactive waste and spent fuel produced both during the operational and decommissioning phases would be handled at the facilities on the Power Station Site that are designed for the sole use of the Wylfa Newydd Project. All radioactive waste would be handled and treated in compliance with UK legislation regarding transportation, storage and processing of the radioactive waste.

9.1.8 As the site-specific design progresses, Horizon will liaise with the relevant nuclear regulators to ensure the waste management strategy is compliant with legislation and includes protection of the public, workers and environment to reduce risk SFAIRP through keeping radiological doses ALARP and environmental effects ALARA. All discharges and waste arisings will be reduced to ALARA levels through the application of BAT and use of the waste hierarchy (as required by the Environmental Permit).

10 References

Table 10-1 Schedule of references

ID	Reference
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RD2	Department of Energy and Climate Change. 2013. *HM Government, Long-term Nuclear Energy Strategy*. BIS/13/630. Department of Energy and Climate Change. London: The Stationery Office.
RD3	Department of Energy and Climate Change. Department of the Environment (Northern Ireland), Scottish Executive and Welsh Assembly Government. 2009. *UK Strategy for Radioactive Discharges*. Department of Energy and Climate Change. London: The Stationery Office.
RD4	The Convention for the Protection of the Marine Environment of the North-East Atlantic (the 'OSPAR Convention') 1998.
RD5	Department of the Environment. 1995. *Review of Radioactive Waste Management Policy: Final Conclusions*, Cm 2919. London: The Stationery Office.
RD6	Department for Environment, Food and Rural Affairs, Department of the Environment (Northern Ireland), Department for Trade and Industry, Scottish Executive and Welsh Assembly Government. 2007. *Policy for the Long Term Management of Solid Low Level Radioactive Waste in the United Kingdom.* PB 12522. Published by the Department for Environment, Food and Rural Affairs. London: The Stationery Office.
RD7	Department of Energy and Climate Change. Department of the Environment (Northern Ireland), Scottish Executive and Welsh Assembly Government. 2016. *UK Strategy for the Management of Solid Low Level Radioactive Waste from the Nuclear Industry.* URN 15D/472. Published by the Department of Energy and Climate Change. London: The Stationery Office.
RD8	Office for Nuclear Regulation, Natural Resources Wales, the Environment Agency and the Scottish Environmental Protection Agency. 2015. *The management of higher activity radioactive wastes on nuclear licensed sites*.
RD9	Nuclear Decommissioning Authority. 2012. *Industry Guidance. Interim Storage of Higher Activity Waste Packages – Integrated Approach*. The Nuclear Decommissioning Authority, Moor Row, Cumbria.
RD10	Isle of Anglesey County Council. 2014. *New Nuclear Build at Wylfa Supplementary Planning Guidance*.
RD11	Department of Energy and Climate Change. 2011. *The Energy Act 2008. Funded Decommissioning Programme. Guidance for New Nuclear Power Stations.* URN 11D/924. Department of Energy and Climate Change. London: The Stationery Office.
RD12	Department of Energy and Climate Change. 2011. *Waste Transfer Pricing Methodology for the disposal of higher activity waste from new nuclear power stations.* URN 11D/923. Department of Energy and Climate Change. London: The Stationery Office.
RD13	Department for Environment, Food and Rural Affairs, Department for Business Enterprise and Regulatory Reform, Wales Office and Northern Ireland Office.

ID	Reference
	2008. *Managing Radioactive Waste Safely. A Framework for Implementing Geological Disposal. A White Paper by Defra, BERR and the devolved administrations for Wales and Northern Ireland*. Cm 7386.
RD14	Department of Energy and Climate Change. 2011. *Overarching National Policy Statement for Energy (EN-1)*. URN 11D/711. London: The Stationery Office.
RD15	Department of Energy and Climate Change. 2011. *National Policy Statement for Nuclear Power Generation (EN-6)*. URN 11D/716. London: The Stationery Office.
RD16	UK Safeguards Office. 2010. *Guidance on International Safeguards and Nuclear Material Accountancy at Nuclear sites in the UK*. London: The Stationery Office.
RD17	Department for Business, Energy and Industrial Strategy and the Nuclear Decommissioning Authority. 2016. *Radioactive Wastes in the UK: UK Radioactive Waste Inventory Report.* The Nuclear Decommissioning Authority, Moor Row, Cumbria.
RD18	Horizon. 2015. *Radiological reference state of Wylfa Newydd Site*. WN01.03.03-S3-EWM-REP-00001
RD19	Amec Foster Wheeler. 2016. *Radiometric and Radiochemical Analysis of Wylfa Rock and Soil Samples*. 206352-0000-DM00-RPT-0001
RD20	Centre for Environment, Fisheries and Aquaculture Science (CEFAS). 2017. *Radioactivity and Food in the Environment 2016.* RIFE-22.
RD21	Nuclear Industry Safety Directors Forum. 2009. *An aid to the design of ventilation of radioactive areas*. Issue 1. NVF/DG001.
RD22	Horizon. 2017. *Wylfa Newydd Project Radioactive Substances Regulation – Environmental Permit Application*. WN0908-HZCON-PAC-REP-00003.
RD23	Department for Business Enterprise and Regulatory Reform. 2008. *Meeting the Energy Challenge. A White Paper on Nuclear Power.* Cm 7296. London: The Stationery Office.
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