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GE Hitachi Nuclear Energy

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BWRX-300 UK Generic Design Assessment (GDA) Chapter E3 - Management Arrangements and Responsibilities

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EXECUTIVE SUMMARY

This chapter of the Preliminary Environmental Report presents information on how management arrangements and responsibilities with the BWRX-300 are identified, defined, and managed in compliance with relevant regulatory requirements and expectations. Regulatory context is addressed, outlining the relevant United Kingdom legislation as well as the requirements and expectations of the environmental regulators in the Generic Design Assessment.

The Requesting Party's responsibilities in the Generic Design Assessment are described and examples of these responsibilities being addressed are provided where appropriate. The interface of the Requesting Party (as the intelligent customer) with the Technical Support Contractor is discussed. The Requesting Party's management framework is outlined, discussing the transfer of information to the operating organisation, the control of documents and records, and the control of corrective measures where non-conformances that affect the environment may arise.

Processes that the Requesting Party utilises to control the design are discussed. The necessary documents that specify high-level design decisions for the BWRX-300 standard plant, which form the overall design basis of the plant, are underpinned, as are the processes to implement requirements into the design. Changes to design are justified and subject to design control measures commensurate with those applied to the original design.

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ACRONYMS AND ABBREVIATIONS

Acronym	Explanation
ABWR	Advanced Boiling Water Reactor
ALARA	As Low As Reasonably Achievable
BAT	Best Available Techniques
BL0	Baseline 0
BL1	Baseline 1
BL2	Baseline 2
BL3	Baseline 3
BWR	Boiling Water Reactor
DP	Developed Principles
DR	Design Reference
EA	Environment Agency
EHS	Environmental, Health and Safety
EMS	Environmental Management System
ESBWR	Economic Simplified Boiling Water Reactor
GDA	Generic Design Assessment
GEH	GE-Hitachi Nuclear Energy
IMS	Integrated Management System
IWS	Integrated Waste Strategy
MLDP	Management and Leadership Developed Principles
MPL	Main Parts List
MSQA	Management for Safety and Quality Assurance
NRW	Natural Resources Wales
NWS	Nuclear Waste Services
ONR	Office for Nuclear Regulation
OPEX	Operational Experience
PER	Preliminary Environmental Report
PIP	Project Implementation Plan
PRD	Product Requirements Document
PSR	Preliminary Safety Report
QAPD	Quality Assurance Program Description
RM	Requirements Management
RMP	Requirements Management Plan
RP	Requesting Party

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Acronym	Explanation
RSR	Radioactive Substances Regulation
SDG	Sustainable Development Goals
SMR	Small Modular Reactor
SQEP	Suitably Qualified and Experienced Personnel
SSC	Structure, System, and Component
TSC	Technical Support Contractor
UK	United Kingdom
US	United States
USNRC	U.S. Nuclear Regulatory Commission

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None.

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REVISION SUMMARY

Revision #	Section Modified	Revision Summary
A	All	Initial Issuance
B	All	Update for end of GDA Step 2 consolidation

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3 MANAGEMENT ARRANGEMENTS AND RESPONSIBILITIES

Introduction

The GE-Hitachi Nuclear Energy (GEH) BWRX-300 is a Boiling Water Reactor (BWR) that has been designed as a Small Modular Reactor (SMR). As the tenth generation of the BWR design, the BWRX-300 incorporates the lessons learned from worldwide programmes and Operational Experience (OPEX) of GEH BWRs, including the Economic Simplified Boiling Water Reactor (ESBWR) and Advanced Boiling Water Reactor (ABWR).

GEH are the Requesting Party (RP) presenting an environment case submission to the United Kingdom (UK) regulators for Generic Design Assessment (GDA) Step 2 for the BWRX-300. This chapter sits within the Preliminary Environmental Report (PER) which is the main deliverable for the environment case submission.

This chapter presents information on how management arrangements and responsibilities for the BWRX-300 are identified, defined, and managed in compliance with relevant UK environmental regulatory requirements and expectations.

The arrangements refer to the organisations and processes that the RP has in place to produce and maintain control of the design while considering related safety and environmental outputs, through the various lifecycle stages. Management for Safety and Quality Assurance (MSQA) assesses evidence and records that demonstrate that due process has been followed in producing these outputs.

GDA focus areas undergoing MSQA assessment in lifecycle Step 1 include:

- Quality Management System for the development of the design and production of the GDA submission
- Identification of organisational structure and competencies required for the development of the design and production of the GDA submission
- Management arrangements for maintaining records
- Arrangements for dealing with regulatory queries, regulatory observations, and regulatory issues
- Management arrangements for control and documentation of the design and design modifications
- Description of expectations from the RP for the operating utility's management system to cover the operations of the reactor throughout its lifetime

Purpose

This report provides a description of the RP's management system in an environmental context and how management responsibilities for GDA, in relation to the environment, are allocated in its organisational structure. There is a strong interface with the corresponding chapter in the Preliminary Safety Report (PSR) – NEDO-34189, "BWRX-300 UK GDA Chapter 17: Management for Safety and Quality Assurance" (Reference 3-1). The PSR is assessed by the Office for Nuclear Regulation (ONR).

Scope

The report scope includes:

- Summary of the management system and how management responsibilities for GDA are allocated in its organisational structure

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- Reference to descriptions in relevant GDA submissions, and discussion of areas relevant to environmental objectives and principles. This includes how the management arrangements and responsibilities contribute towards sustainability.

Claims, Arguments and Evidence

The environmental claim's structure, as discussed in NEDC-34141P, "BWRX-300 UK GDA Environmental Strategy" (Reference 3-2), presents the overall claim:

- "The BWRX-300 is capable of being constructed, operated, and decommissioned in accordance with the standards of environmental, safety, security and safeguard protection required in the UK."

The environmental Level 1 claim is:

- "The design of the BWRX-300 SMR has been optimised to reduce environmental impacts to As Low As Reasonably Achievable (ALARA) throughout the whole lifecycle (construction, commissioning, operation and decommissioning)."

The environmental Level 2 claims are not directly relevant to this chapter, however, management responsibilities affect how the claims are met.

Document Structure

Following on from the introduction, this PER chapter includes the following sections:

- Section 3.1 – Regulatory Context:
 - Reference to relevant UK environmental legislation
 - The role of the Environment Agency (EA) in the GDA
 - Regulatory objectives and principles.
- Section 3.2 – Requesting Party:
 - An overview of GEH's experience with reactor design and GEH responsibilities in GDA
 - Information on GEH's management systems in the GDA
 - Overviews on design control processes and design principles

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3.1 Regulatory Context

3.1.1 Relevant United Kingdom Environmental Legislation

The development of processes and procedures within the GEH management system supports compliance with UK legislation including, but not limited to:

- “Nuclear Installations Act 1965” (Reference 3-3), which defines the appropriate environment authority, which is the EA, in the case of England, and Natural Resources Wales (NRW) in the case of Wales
- “The Health and Safety at Work Etc. Act 1974” (Reference 3-4)
- “The Environmental Protection Act 1990” (Reference 3-5), which expects parties to exercise a duty of care. The Act also includes ‘Part V: Enactments relating to Radioactive Substances’
- “The Ionising Radiation (Basic Safety Standards) (Miscellaneous Provisions) Regulations 2018” (Reference 3-6)
- “The Environmental Permitting (England and Wales) Regulations 2016” (Reference 3-7), which discusses radioactive waste interventions and ‘power to provide facilities for disposal’ and ‘power of disposal’
- “The Controlled Waste (England and Wales) Regulations 2012” (Reference 3-8)

The arrangements delivered within the management system also support compliance with regulatory requirements set out in the ONR “Licence Condition Handbook” (Reference 3-9) and the EA “Radioactive Substances Regulation (RSR): Objectives and Principles” (Reference 3-10).

These are UK regulations and expectations that the RP is considering as part of GDA.

3.1.2 Environment Agency

Environmental assessment at GDA is led by the EA, working with NRW. The EA work to create better places for people and wildlife, and support sustainable development, according to “EA2025: Creating a Better Place” (Reference 3-11). Within the GDA, the RP is required to demonstrate that the nuclear power plant design meets the regulators requirements and expectations, according to “New nuclear power plants: Generic Design Assessment guidance for Requesting Parties”, (Reference 3-12).

The ONR, along with the EA, have developed the GDA process to assess the acceptability for use of new nuclear power plant designs in the UK.

3.1.2.1 Environmental Agency Requirements and Expectations in Generic Design Assessment

The assessment activities for EA during GDA, and expectations for the RP are set out in Reference 3-12.

According to the EA’s “Environment: Introductions and Expectations” presentation, (Reference 3-13), the key regulatory expectations on MSQA are:

- Support of positive safety and environmental culture by the organisation and leadership
- Capability of the organisation to deliver GDA outputs
- Adequacy of the quality management system in terms of suitable standards such as IAEA GSR Part 2 “Leadership and Management for Safety” (Reference 3-14), ISO 9001 “Quality Management Systems” (Reference 3-15) and/or ISO 14001 “Environmental Management Systems” (Reference 3-16)

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- Assignment of the right priority to safety, security, and the environment by the management system
- Use of process monitoring and audits by the RP to confirm the adequacy, suitability, and effectiveness of the GDA processes

3.1.3 Environment Agency Regulatory Objective and Principles

This section introduces the “RSR: Objective and Principles” (Reference 3-10) and the suite of generic Developed Principles (DP) within EA’s “RSR generic developed principles: regulatory assessment” (Reference 3-17), which the environmental regulators expect to be considered in the GDA.

The RSR objective (Reference 3-10) states:

“Our objective in regulating radioactive substances is to protect people and the environment from the harmful effects of ionising radiation, now and in the future. We also aim to protect and enhance the environment as a whole. We fulfil this objective by applying relevant legislation, government policy and international standards.”

The key RSR principles (Reference 3-10) relevant to underpinning the management arrangements for the UK BWRX-300 include:

Principle 2: Optimisation – *“Radiological protection must be optimised to make sure that people’s exposure to ionising radiation from the disposal of radioactive waste is kept ALARA, taking into account environmental, social and economic factors.”*

This principle is conveyed in GEH CP-03-100, “Design Control” (Reference 3-18), where there is a need to change and improve the design for safety, in addition to promotion of the protection and enhancement of the environment.

Principle 8: Best Available Techniques (BAT) – *“Operators must use BAT for the management of radioactive waste.”*

Statutory guidance requires BAT to be used, and the prevention of the unnecessary creation of discharges or radioactive waste. In addition, BAT must be used to minimise the quantity and activity of the waste that is created to mitigate the impacts on people and the environment through achieving ALARA. These decisions and actions would stem from inclusion of the BAT principle as part of the BWRX-300 design development.

NEDC-34231P, “Alignment with Sustainability, the RSR Objectives and Principles and Generic Developed Principles” (Reference 3-19) presents the RSR principles and BWRX-300 alignment with them.

The generic DPs are a suite of EA documents which set out expectations for permit holders undertaking activities where radioactive substances are involved. The “Management and Leadership for the environment: generic Developed Principles” (Reference 3-20) are directly applicable to the MSQA topic for GDA. The Management and Leadership Developed Principles (MLDPs) are based largely on national and international guidance on management and leadership for the safety of nuclear facilities.

3.1.3.1 Management and Leadership Developed Principles

The “Management and Leadership for the environment: generic Developed Principles” (Reference 3-20) describe how the EA expects the operator to manage its business and provide leadership to ensure that the business minimises its impact on people and the environment from the use of radioactive substances.

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MLDP1 – Establishing and Sustaining Management Leadership

MLDP1 (Reference 3-20) states that:

“All companies/organisations whose activities have the potential to adversely affect people, or the environment should establish and sustain effective leadership and management for the environment to ensure that people and the environment are properly protected from the adverse effects.”

MLDP1 Considerations

The prime responsibilities for environmental protection always fall to the organisation or person responsible for the activities that could give rise to adverse effects. Others (organisations or people) who contribute to, or might affect, an organisation's environment protection performance should be made aware of their responsibilities.

Effective management for the environment includes:

- Leadership
- Capability
- Decision making
- Learning

Alignment is demonstrated as part of the GDA through the GEH Integrated Management System (IMS) which is used within NEDC-34150P, “Project Implementation Plan” (PIP) (Reference 3-21), to describe the overall arrangements for the successful conduct and completion of GDA. The hierarchy of the IMS for GDA has NEDO-11209-A, “Nuclear Energy Quality Assurance Program Description” (QAPD) (Reference 3-22) and the Project Work Plan at the top, flowing down to GEH management documents, then GEH detailed working documents and GDA deliverables at the bottom.

MLDP2 – High Standards of Environmental Protection

MLDP2 (Reference 3-20) states:

“Directors, managers and leaders at all levels should focus the organisation achieving and sustaining high standards of protection of people and the environment.”

MLDP2 Considerations

Focusing the organisation includes:

- Establishing strategies, policies, plans, systems, goals, and standards for protection of people and the environment
- Ensuring that these are delivered throughout the organisation
- Providing direction and oversight that encourages a strong environment protection culture to underpin operation
- Visibly demonstrating commitment to environment protection through activities
- Recognising and resolving conflict between environmental protection and other goals
- Ensuring that any reward systems promote environment protection
- Endorsing behaviour that protects people and the environment
- Challenging behaviour that threatens people or the environment
- Reinforcing the value of environment protection in interactions with staff, contractors, suppliers, stakeholders, and the public

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- Engaging staff at all levels through proper consultation and involvement to secure collective responsibility, personal accountability, shared values, and improvement of environment protection
- Providing training in environment protection goals and methods
- Supporting oversight of environment protection, led by the management board
- Securing an effective, preferably integrated, management system throughout the organisation

Alignment with this principle is demonstrated as part of the GDA through the GEH IMS.

MLDP3 – Capability

MLDP3 (Reference 3-20) states:

“Organisations should have the capability to secure and maintain proper protection of people and the environment.”

MLDP3 Considerations

Capability includes:

- Having sufficient human resources with regard to numbers, skills, competencies, and knowledge at all times
- Having effective processes for assessing, monitoring, and maintaining the sufficiency of human resources
- Having effective processes for assessing all organisational changes, planned and unplanned, that might affect environment protection
- Having effective processes to secure and maintain the technical, behavioural, managerial, and leadership competencies of all individuals whose performance might affect environment protection
- Ensuring that all individuals who have responsibilities for environment protection have sufficient personal authority, including access to resources, to deliver those responsibilities effectively
- Having an organisational structure and management system (preferably integrated) that secures effective co-ordination and collaboration by all those directly and indirectly involved in the organisation’s activities that might affect environment protection
- Taking account of factors that affect the reliable performance of organisations when designing organisational structures, jobs, processes, and procedures that might affect environment protection
- Having clear roles, responsibilities, accountabilities, objectives, expectations, and performance standards for environmental protection
- Having effective supervision and oversight of all activities and individuals that might affect the environment
- Having effective processes for capturing, assessing, interpreting, understanding, and communicating plant, system, equipment and process performance and environmental information, so that faults, problems, and issues that might have adverse effects on the environment are identified early. These processes include having expertise and knowledge of expected and unexpected performance and consequences, and arrangements for ensuring that this capability is maintained throughout all stages of facility lifecycle.

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- Having effective processes for knowledge management such that sufficient relevant information is available to those who make decisions that might affect environment protection – including matters relating to how information is structured and communicated, as well as its content
- Having effective processes for managing (including identifying, updating, validating, approving, preserving, and making available) records and documents that are relevant to environment protection

Alignment with this generic developed principle is demonstrated as part of the GDA through the GEH IMS.

Documentation across the PER and PSR also highlights the technical provisions of effective management and leadership for the environment, aligning to the GDA requirements. PSR Chapter 17 (Reference 3-1) provides a high-level description of how MSQA is achieved within the GDA process for BWRX-300.

MLDP4 – Decision Making

MLDP4 (Reference 3-20) states:

“Decisions at all levels that might affect environment protection should be rational, objective, timely, transparent and prudent.”

MLDP4 Considerations

Effective decision-making processes should be used for all decisions that might affect the environment. This includes:

- Ensuring a high priority is given to environment protection and is evident in all decisions that might affect the environment
- Ensuring that an integrated approach is taken, all relevant matters are taken into account and priorities properly assigned, in decisions where there is conflict or potential conflict between environment protection and any other goals of the organisation (for example, relating to health, safety, security, quality, economic and commercial matters)
- Ensuring that relevant information, including data and opinions, is sought, considered, and used to inform decisions that might affect the environment
- Evaluating the quality of data and opinions
- Questioning assumptions
- Exploring all relevant scenarios of expected and unexpected behaviours and consequences that might affect the environment
- Considering short and long term implications of decisions
- Allowing for error, uncertainty and the unexpected, and demonstrating a prudent approach
- Inviting effective active challenge and review of decisions, made at all levels of the organisation, that might affect environment protection

GEH considers potential environmental impacts through its decision-making process, in alignment with MLDP4. For the GDA, this is achieved through CP-03-102, “Product Safety Program” (Reference 3-23), and necessary processes mentioned in the GEH IMS are applied.

In addition, NEDO-34223 “BWRX-300 UK GDA, Chapter E6: Demonstration of BAT Approach” (Reference 3-24) refers to the options assessment processes that are used to

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address both BAT and As Low As Reasonably Practicable. This ensures that multiple options are considered by management and allows for the selection of an optimal method.

MLDP5 – Learning from Experience

MLDP5 (Reference 3-20) states:

“Organisations should learn from their own and others’ experience so as to continually improve their ability to protect the environment.”

MLDP5 Consideration

The organisation’s ability to protect the environment includes leadership, capability and decision making. Effective processes for learning should be established and sustained by organisations whose activities might adversely affect people and the environment.

Effective processes include active arrangements for gaining, assessing, and acting upon information from all relevant sources. Sources of information include staff at all levels, monitoring, review, and audit activities relating to strategies, reviews by external organisations of such matters, performance benchmarking with other relevant organisations and tracking corrective actions arising from learning.

MLDP5 is showcased in the GDA by the Measurement, Assessment and Improvement process which is detailed in the PIP (Reference 3-21). This refers to the internal and external assessment that will be undertaken to learn from OPEX from both within and outside GEH. Monitoring and assessment will provide the opportunity for feedback, corrective and preventative measures.

3.1.4 Sustainability

GE Vernova represents the energy portfolio business of GE, having spun off from GE in early 2024. Within this separation GE Vernova has retained the principles and pillars for the development of sustainability strategy which are aligned to the United Nations Sustainable Development Goals (SDGs) in “GE Vernova Sustainability Framework” (Reference 3-25). As part of this, GE Vernova policy is to move towards decarbonisation and commitments towards carbon neutrality and net zero ambitions. GE publishes a report on an annual basis, “GE Vernova 2022 Sustainability Report: A Transformative Era of Action” (Reference 3-26), giving examples of engagement with the United Nations SDGs across the business, and offers a range of key metrics and performance. It is anticipated that GE Vernova will continue this practice and that this will feed into the management structure of the BWRX-300. More information on sustainability is found in NEDO-34228, “BWRX-300 UK GDA Integrated Waste Strategy” (IWS) (Reference 3-27). The IWS (Reference 3-27) supports the PER and provides an overview of the relevant regulatory requirements and principles that underpin the BWRX-300 design.

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3.2 Requesting Party

3.2.1 Experience with Reactor Design

GEH has a long history of designing nuclear reactors, such as the ABWR and the ESBWR, which are earlier BWR evolutions from which the BWRX-300 has been developed. GEH has experience in designing SMRs, Large Boiling Water Reactors and Sodium Fast Reactors.

The BWRX-300 uses water as a coolant and employs natural circulation and natural phenomena-driven safety systems as stated in NEDC-34137P, “BWRX-300 UK GDA Design Evolution” (Reference 3-28). This is GEH’s tenth generation BWR design and represents the simplest design to date since General Electric (GEH’s predecessor in the nuclear business) began developing nuclear reactors in 1955. The BWRX-300 is an evolution of the U.S. Nuclear Regulatory Commission (USNRC)-licensed, 1,520 MWe ESBWR. It is designed to provide clean, flexible energy generation. The design evolution of BWRs is shown in Table 3-1.

3.2.2 Requesting Party Responsibilities in Generic Design Assessment

The “GDA guidance for Requesting Parties” (Reference 3-12), states that the EA collaborates with the ONR and NRW to ensure that any new nuclear power station meets high standards for environmental protection, as well as safety, security, and waste management. Guidance statements associated with project management and related arrangements, and the RP position, are summarised in Table 3-2.

3.2.2.1 Boundaries of Responsibilities

GEH is the BWRX-300 designer and has commenced the licensing process in the UK by entering GDA. As the BWRX-300 progresses beyond GDA to site-specific licensing and environmental permit applications, responsibilities will start to transfer from GEH to a future development company.

Following on from GDA, the site-specific design and environmental permit applications will be developed.

Subsequent roles for GEH in the site-specific development stage may include being the technology provider in the construction stage, as well as vendor support and fuel supplier in the operation stage. In the production of the GDA deliverables, GEH has produced an overview to the approach to decommissioning and end-of-life of the BWRX-300 generic design, found in NEDO-34193, “BWRX-300 UK GDA Chapter 21: Decommissioning and End of Life Aspects” (Reference 3-29). GEH’s role in the decommissioning of a developed and operated UK BWRX-300 is subject to a future development stage outside the scope of GDA Step 2.

3.2.3 Requesting Party Management of Generic Design Assessment

3.2.3.1 Quality Management System

The GEH project management and quality arrangements for conduct of GDA assessments are in accordance with the GEH IMS and are described in the PIP (Reference 3-21). The services of this project are provided in accordance with the QAPD (Reference 3-22). The programme meets American Standards Mechanical Engineers’ Nuclear Quality Assurance (NQA-1) and has been endorsed by the USNRC.

3.2.3.2 Project Implementation Plan

The PIP (Reference 3-21) contains project management and quality arrangements for GDA. It describes the arrangements between GEH and Technical Support Contractor(s) (TSC)s, contracted and managed by GEH, to support GDA activities. PSR Chapter 17 (Reference 3-1) is also supported by the PIP.

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The following management arrangements are all underpinned in the PIP (Reference 3-21):

- Suitably Qualified and Experienced Personnel (SQEP) within the GDA project
- Document control interfaces summary
- Regulatory interface office arrangements, submissions, meetings, actions, and correspondence
- Master Document Submission List/Document List arrangements
- Project quality and project management oversight
- Lessons learned/OPEX
- Head document and safety, safeguards, security, and environment reports development control and management arrangements.

The GEH Product Lifecycle Management system, as part of the GEH IMS, controls the necessary reviews, approvals, and document control and records management functions required for maintaining the PIP (Reference 3-21). The PIP will be updated as necessary to incorporate any project changes, relevant good practice, and lessons learned/OPEX during GDA. Internal reviews are conducted by GEH to ensure the plan is on track and to escalate any 'at risk' areas that require additional project management or technical support.

3.2.3.3 EHS Management Programme

The GEH Environmental, Health and Safety (EHS) management programme is documented in GEH Business Policy P-03, "Environmental, Health, and Safety Commitment to Excellence" (Reference 3-30). CP-27-106 "Health and Safety" (Reference 3-31) implements GEH Policy P-03 and the overall structure of the EHS programme for GEH which includes the roles and responsibilities of Management, Employees, and Safety Committees in achieving health and safety excellence. CP-27-102 "Environmental Protection" (Reference 3-32) is for the Wilmington site.

As described in CP-27-106 Health and Safety (Reference 3-31), the core of the GE Vernova EHS Management System is Framework 2.0. It is a system tool and assessment process that mandates implementation and performance to tightly controlled criteria. Framework 2.0 is continually reviewed, evaluated, and maintained at the GE Vernova corporate level for deployment throughout GE Vernova. Framework 2.0 also includes requirements for environmental management systems, including a review of environmental defenses; air, waste, and water. All GEH sites have implemented Framework 2.0, adopting the risk-based approach whereby application at the various organisational levels dictates the required system elements for implementation. Evaluation and management are through digitised GE Vernova web-based tools. Framework 2.0 will be implemented at all UK GEH sites and facilities.

In 2016, Lloyd's Register Quality Assurance reviewed GEH's enterprise-wide Environmental Management System (EMS) against the requirements of ISO 14001:2015 (Reference 3-16).

Lloyd's Register concluded:

- The design of the EMS is aligned with ISO 14001:2015 (Reference 3-16). All elements of the standard have been addressed as documented requirements of the EMS.
- Environmental management systems have been established based on requirements of the EMS.
- No evidence was identified to indicate sites were implementing environmental management systems other than those established through implementation of the EMS.

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- Programmes and initiatives linked to implementation of the EMS were contributing to reported improvements in environmental performance.

GEH is committed to achieving ISO 14001 certification. This certification will demonstrate that GEH is dedicated to minimising the company's environmental impact and ensuring the health and safety of employees and align with international regulations best practices.

3.2.4 Requesting Party Organisational Structure

The RP's organisational structure implementing GDA is presented in the PIP (Reference 3-21). This identifies how the roles of teams and individuals from both the intelligent customer and the TSCs are organised.

3.2.5 Requesting Party Competency Management

Competency management and the provision of SQEP are presented within the PIP (Reference 3-21). GEH has also implemented a Training Proficiency Surveillance Plan for GDA. TSCs are assisting GEH, in a consulting capacity, to ensure adequate personnel are available to move forward in the GDA process.

3.2.6 Requesting Party Management Framework

3.2.6.1 Requesting Party Management Responsibilities to the Environment

GEH management arrangements have been applied to support the generic design of the UK BWRX-300 in meeting GDA requirements for the environment. Ultimate responsibilities to the environment for the UK BWRX-300 will transfer in future to the development company and operating organisation. This will ensure environmental protection is maintained throughout the BWRX-300 lifetime.

GEH will continue, as necessary, to assist the future development company and operating organisation with advice and support during the plant lifecycle, including during plant operation, to ensure that they are able to satisfy requirements for safety and the environment. GEH has been able, and will continue, to share OPEX and knowledge with other designers/operators to support incorporation of lessons learned in this project and future projects.

GEH will work with the future development company and operating organisation to ensure that the appropriate knowledge is transferred from design and construction of the plant, ensuring that they can fully discharge their responsibilities under the environmental permit, and other regulations and legislation.

The QAPD, states in Part IV Regulatory Commitments (Reference 3-22), that GEH commits to compliance with the standards mentioned in the regulatory requirements. Those relevant for GDA are:

- ISO 9001:2015, "Quality Management Systems" (Reference 3-15)
- IAEA GSR Part 2: "Leadership and Management for Safety" (Reference 3-14)
- ISO 14001:2015, "Environmental Management Systems" (Reference 3-16)

3.2.6.2 Knowledge and Information Transfer to the Development Company and Operating Organisation

GEH will cooperate with the future development company and operating organisation and ensure that design knowledge and information influencing safety and the environment are communicated and transferred in an appropriate manner. GEH will implement robust processes for transferring knowledge, compatible with the future development company and operating organisation.

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3.2.6.3 Design Authority

The design authority is GEH, as the intelligent customer. They are the authority on the design intent of the plant, such that during future lifecycle stages they can understand the effects of proposed maintenance and modifications.

3.2.6.4 Documents and Records Control

Safety and quality for the UK BWRX-300 will be assured and maintained by use of suitable documents and records throughout the plant lifecycle. The QAPD (Reference 3-22) states that for quality assurance records, GEH has established measures to provide provisions for the identification, administration, receipt, storage, preservation, safekeeping, retrieval, and disposition of all records such that damage or loss does not occur. Quality records are established to provide objective evidence of conformance to requirements and effective implementation of the GEH quality management system. Additionally, the records system is defined, implemented, and enforced in accordance with written procedures, instructions, or other documentation.

Design documentation and records that provide evidence of design and design verification processes are appropriately performed, collected, stored, and maintained in accordance with QAPD (Reference 3-22). The records include final designs and revisions as well as documentation that identifies important steps in the design process, including sources of design inputs, that support the final design.

3.2.6.5 Control of Non-conformance, Corrective and Preventative action

GEH implements a corrective action programme, as discussed in QAPD (Reference 3-22). This identifies, controls, documents, classifies, and corrects conditions adverse to quality. It facilitates the identification of trends and implementation of preventative actions.

3.2.7 Requesting Party Processes

3.2.7.1 Design Control

In controlling the design process, GEH's goal is to ensure that a design, along with its associated design documentation, meets all applicable technical, regulatory, and contractual requirements. The QAPD (Reference 3-22) discusses the inputs, process, analyses, verification, change control, interface control, software design control, and documentation and records as part of design control.

3.2.7.2 Design Decisions

006N4173, "BWRX-300 Composite Design" (Reference 3-33) specifies high-level design decisions for the BWRX-300 standard plant which form the overall design basis of the plant. It states that the plant safety strategy, incorporating the concept of Defense Lines, is developed using IAEA based guidance for safety assessments and safety design.

Decisions or issues that have significant cost, schedule, or regulatory risk are managed using a systems decision process that provides a means for traceability and ensures that no knowledge or investment is lost throughout the project lifecycle, as stated in 006N3139, "BWRX-300 Design Plan" (Reference 3-34). The process also provides a means for managing systems decisions to aid in monitoring and controlling the scope of a complex systems design project.

The decision-making process is commensurate to the overall risk level to the project, for example, looking at the structures, systems and components level, the plant level, or wider-reaching issues. The wider-reaching issues that have a significant effect on cost or scope of the BWRX-300 Standard Design are reviewed by the Design Center Working Group (DCWG) to help control changes to NEDC-34154P, "Design Reference (DR) Report" (Reference 3-35). The DR report lists all the documents that comprise the design of the BWRX-300 power plant

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that are applicable to the GDA submissions provided to the regulators. The DCWG focuses on resolving design and regulatory issues associated with the BWRX-300 design that are common to all sites. As part of resolving the design, the design changes are justified and subject to design control measures commensurate with those applied to the original design, in accordance with CP-03-100 (Reference 3-18). The affected groups or organisations that reviewed and approved the original design documents are included in the approval of the design changes.

3.2.7.3 Phased Design Process in the Standard Design Development

The first-of-a-kind BWRX-300 design is being developed for international deployment using a Standard Design approach to minimise the design variation from project to project. An iterative design process based on design requirements has been adopted, which is expressed in terms of four design phases in the Design Plan (Reference 3-34). The design phases for development of the BWRX-300 design are described in Table 3-3.

It is important to note that the design of individual systems, and in some cases components, will progress through these design phases at different paces, beginning with primary systems and then proceeding to support systems. Therefore, for example, some systems may be in Baseline 2 (BL2) at the same time that other systems are still in Baseline (BL1). Each design phase is complete for the overall plant design when all systems have completed that design phase.

3.2.7.3.1 Design Scope and Responsibilities

The 'Power Block' is defined as the Reactor Building, Turbine Building, Control Building, Radwaste Building, and the corresponding systems and components within these buildings. To support standardisation across the Power Block, GEH will complete the Power Block standard design through the BL2 design phase with the support of an architect engineering firm. The Baseline 3 (BL3) design of the Structure, System, and Component (SSC) outside of the Power Block will be performed according to a division of responsibility for each site-specific project. BL3 design for the SSC outside of the Nuclear Steam Supply System (NSSS) is expected to be performed by a project-specific architect engineering firm. GEH may receive copies of this design information but is not expected to be responsible for the plant-specific design for this scope (Reference 3-34).

The generation and flow down of requirements is described in 005N9036, "BWRX-300 Requirements Management Plan" (RMP) (Reference 3-36).

3.2.8 Requesting Party Design Principles

3.2.8.1 Requirements Management Plan

A requirement is a statement, denoted by the word "shall", which requires a discipline, platform, system, subsystem, or component to perform an action or otherwise meet some constraint. Requirements are driven by a basis, which provides the rationale and justification for the requirement. Requirements describe the necessary functions and features of the BWRX-300 design to be conceived, designed, implemented, and ultimately operated.

The BWRX-300 design is following a Systems Engineering Design approach, whereby project requirements are created from source requirements and then decomposed from the plant level, to the system level, and finally to the component level. This provides a hierarchical flow path of requirements, with validation and decision-making processes between each level to document the basis for plant, system, and component design.

GEH have developed a RMP (Reference 3-36) that covers the full scope of the Requirements Management (RM) process, from elicitation of source requirements through to validation and testing to ensure that requirements have been met by the BWRX-300 design. The RMP also describes how requirements are handled by internal tools.

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The RM process interfaces with the development of the BWRX-300 design through the phased process. This integrated approach ensures that potential issues (e.g., incompatible systems or components) are identified and addressed early in the design process.

Key objectives of the RM process include:

- Traceability – relationships established between requirements and verification and validation
- Change impact assessment – determination of the impact of proposed design changes on upstream and downstream requirements
- Completeness of design – forward traceability resulting in an auditable trail of requirements in the design documentation, and evidence that the completed design meets the top-level source requirements
- Control of scope – requirements are not introduced without a basis, such that the introduction of unnecessary features and functions is prevented
- Consistency – common understanding of RM across the various organisations and disciplines involved in the BWRX-300 design

Table 3-4 shows the RM hierarchy for BWRX-300. Information flow and traceable decision-making from one level to the next ensures that source requirements are implemented at the plant, system, and component level such that the final design meets all relevant legislative and regulatory requirements.

3.2.8.2 Product Requirements

005N1084, “BWRX-300 Product Requirements Document” (PRD) (Reference 3-37), defines the high-level requirements that the standard design must satisfy. The PRD also defines the potential markets for the standard design, which drive the regulatory requirements that must be satisfied by the design. The PRD is the source for the key stakeholder requirements; is managed by the Product Management team and provided as an input to the engineering design process.

There are several strategies for how the requirements that flow down from the PRD and applicable regulations can be incorporated into the Standard Design and how they are applied to a specific project.

The most straightforward method for accomplishing the objectives of the international Standard Design concept is to incorporate all requirements that flow from the PRD into the Standard Design. This would involve ensuring that the regulatory requirements, codes, and standards from all regions the PRD defines as the BWRX-300 market are incorporated into the design. Although this method would minimise the risk that the Standard Design does not meet the full range of requirements, it would also be the most difficult to achieve given the potential breadth of requirements that can be applied in different regions under different regulatory regimes. Given the challenge of incorporating all possible requirements into the Standard Design, a hybrid strategy has been adopted for BWRX-300 in the Design Plan (Reference 3-34). This applies a representative subset of requirements during the initial development of the design, derived from U.S. and Canadian regulatory frameworks, and guidance and recommendations from the IAEA. When the Standard Design is applied to a specific project (in the project-specific BL3 design phase), application engineering will be performed to assess alignment with project-specific requirements (e.g., local legislative and regulatory requirements).

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Key elements of the application engineering process may be summarised from the Design Plan (Reference 3-34) as follows:

- Project-specific requirements, either from the customer or the applicable regulatory body, are identified and documented
- Project-specific requirements that are not fully satisfied by one or more Standard Design requirements are inserted into the project RM process, and any resulting changes to the design are identified
- The expected performance of the Standard Design under site-specific conditions is evaluated. These evaluations may also drive project-specific requirements or design changes.

3.2.8.3 Summary of Standard Design Approach

In summary, BWRX-300 projects are expected to proceed as follows from the Design Plan (Reference 3-34):

1. The lead project will proceed as the Standard Design project through to the BL2 design phase. At the end of BL2, the Standard Design will be finalised and applied to the Standard Design Main Parts List (MPL). A Standard Design project will exist in the RM tool.
2. For the lead project and each new project, a site-specific BL3 design phase is performed as summarised below:
 - a. Application engineering is performed. Project-specific requirements (including local legislative and regulatory requirements) may be inserted into the RM process to drive any necessary design changes.
 - b. Needed design changes are implemented to meet project-specific requirements, using the Standard Design as the starting point. Any changes to the design are managed through the steps defined in GEH's procedure document CP-03-100 (Reference 3-18).
 - c. Project-specific requirements are considered by GEH for potential incorporation into the Standard Design, potentially as a Standard Design variant.
 - d. Project-specific records, relevant Standard Design documents, and the MPL are updated as appropriate.

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3.3 Conclusion

This chapter of the PER has outlined the UK regulatory context for the consideration of the environment in the management arrangements and responsibilities for a new nuclear power station. To demonstrate alignment with the UK regulatory context, management systems and design processes of the RP have been identified.

The information relating to the RP within this report is intended to provide assurance to the UK environmental regulators that the RP processes are aligned to GDA regulatory expectations. Consideration of how quality assurance is maintained in these processes is outlined, along with implementation of corrective measures where design non-conformances may occur.

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Table 3-1: Design Evolution of BWRs

Product Line	First Commercial Operation Date	Representative Plant/Characteristics
BWR/1	1960	Dresden1 Initial commercial-size BWR
BWR/2	1969	Oyster Creek Plants purchased solely on economics Large direct cycle Isolation condensers
BWR/3	1971	Dresden 2 First jet pump application Improved Emergency Core Cooling System: spray and flood capability
BWR/4	1972	Vermont Yankee Increased power density (20%)
BWR/5	1978	Tokai 2 Improved Emergency Core Cooling System Valve flow control
BWR/6	1981	Kuosheng 1 Compact control room Solid-state nuclear system protection system
ABWR	1996	Kashiwazaki-Kariwa 6 Reactor internal pumps Fine-motion control rod drives Advanced control room, digital and fibre optic technology Improved Emergency Core Cooling System: high/low pressure flooders
ESBWR	-	Natural circulation Passive Emergency Core Cooling System
BWRX-300	-	Loss Of Cooling Accident mitigation Reactor building built from second generation steel-concrete composite modules

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Table 3-2: Joint Guidance Statements for Generic Design Assessment and Confirmation of Compliance

Guidance Statement – The Requesting Party Must:	Is This Met?
Put in place their project management and technical teams.	Yes. The PIP (Reference 3-21) outlines the project management and technical teams. It also defines interactions with TSCs in production of deliverables.
Implement their arrangements for preparing the environmental case submission.	Yes. The PIP (Reference 3-21) states that GEH expresses intent of submitting final versions of the PER submissions at the end of Step 2.
Agree with EA and implement the interface arrangements to be used throughout GDA, including meeting arrangements and the Master Document Submission List format.	Yes. This is referred to in the PIP (Reference 3-21). Interface arrangements are in place to facilitate the exchange of information and progression of GDA activities.
Include a plan for engaging with Nuclear Waste Services (NWS) to obtain an expert view on the disposability of radioactive wastes, including any more challenging wastes (such as problematic or novel waste streams) arising across the reactor lifecycle.	Yes. Addressed in the IWS (Reference 3-27). GEH have engaged NWS.
Make sure EA have full access to any commercially confidential information relevant to EA assessments, including information which is the property of third parties.	Yes. GEH has implemented arrangements for this in Step 1 to facilitate access to information specified in the Guidance for Requesting Parties (Reference 3-12).
Obtain all the necessary export licences to enable the transfer of information to and from the UK to all relevant organisations and countries for the GDA.	Yes. GEH has implemented arrangements for this in Step 1. Information transfers are enabled and a request for information system is in place to provide information for the PER.

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Table 3-3: BWRX-300 Design Phases

Design Phase	Description
Baseline 0 (BL0)	<ul style="list-style-type: none">• Gathering of top-level requirement sources (such as high-level BWRX-300 product requirements, regulatory/legislative requirements), and establishment of relationships to lower level requirements (plant, system, component)• High-level conceptual system designs are established to initiate the BWRX-300 iterative design process
Baseline 1 (BL1)	<ul style="list-style-type: none">• Development of specific design definition of primary SSC• Technical reviews to confirm the adequacy of design requirements and objectives
Baseline 2 (BL2)	<ul style="list-style-type: none">• Completion of the BWRX-300 Standard Design• Technical review to verify the acceptability of the Standard Design
Baseline 3 (BL3)	<ul style="list-style-type: none">• Application of the BWRX-300 Standard Design to a particular site-specific project• Finalisation of system and component design in preparation for construction activities• Technical review to verify the final plant design, including any project-specific changes

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Table 3-4: BWRX-300 Requirements Management Hierarchy

RM Level	Description
Source level	<ul style="list-style-type: none">• Product requirements – high-level expectations that all BWRX-300 plants must satisfy to facilitate configuration management and design repeatability.• Owner's requirements – highest level requirements, including local legislative/regulatory requirements, that must be satisfied for a given BWRX-300 project. These requirements are introduced into the RM process at the BL3 design phase.• Regulations and Orders (R&O) - regulatory requirements (established by federal, state, and local government regulators, e.g., U.S. NRC 10 CFR Part 50).• Codes and Standards (C&S) – regulatory and industry C&S.
Plant level	<ul style="list-style-type: none">• Plant requirements - requirements that require multiple systems to work in concert to achieve overall fulfillment.• Common requirements - A requirement that applies to multiple systems or components and aims to achieve standard attributes or behaviour across the systems or components. Examples include piping standards and wiring standards, which may be derived from R&O, from C&S, or from experience.
System level	<ul style="list-style-type: none">• System requirements - requirements that are satisfied by a single system but require multiple components to work in concert with each other to achieve fulfillment.
Component level	<ul style="list-style-type: none">• Component requirements – requirements that are applicable to a specific component of a system.

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