HOLTEC BRITAIN

A Holtec International Company

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PSR Part A Chapter 1 Introduction

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1.1 INTRODUCTION

This chapter introduces the Holtec Small Modular Reactor (SMR) SMR-300 and the corresponding Safety, Security and Environmental Case (SSEC)[1] documentation presented as part of the Step 2 Generic Design Assessment (GDA) submission. The SSEC is the logical and hierarchical set of documents that describe risk in terms of the hazards presented by the generic SMR-300 on the generic site [1], and those reasonably practicable measures that need to be implemented to prevent or minimise harm to the workforce, the public and environment.

Holtec International is undertaking Steps 1 and 2 of the UK GDA process. The Requesting Party (RP) for the GDA is Holtec International, with the GDA managed by Holtec Britain, the UK subsidiary of Holtec International. This chapter also provides an overview of the RP, Holtec International, and the generic SMR-300. More detail on the evolution of the generic design, the Design Reference Point (DRP), and the generic site is provided in Chapter 2 'General Design Aspects and Site Characteristics' [2].

1.1.1 Purpose

This chapter consists of the following subchapters:

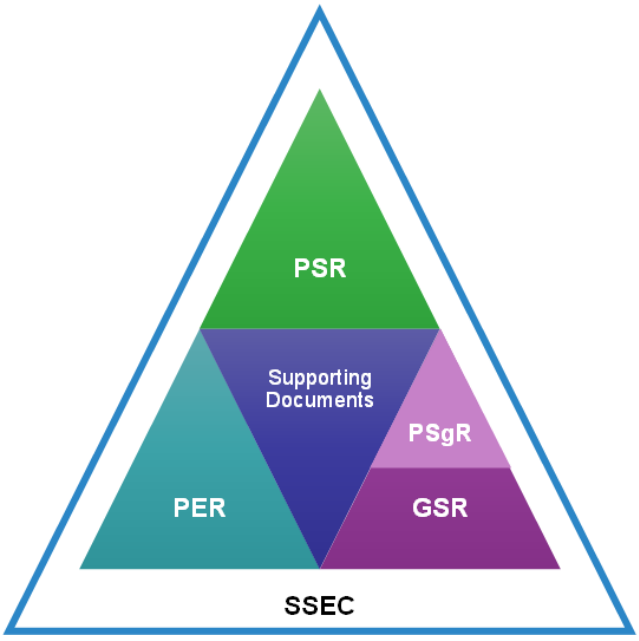
- **Introduction** – gives a high-level introduction, purpose, and scope for the Step 2 GDA SSEC.
- **UK Nuclear Regulatory Regime and Generic Design Assessment** – explains the United Kingdom (UK) regulatory regime and what the GDA process is, giving the main expectations on the RP. An overview of the US Regulatory Framework is also outlined within this sub-chapter and the notable difference with the UK regime.
- **Generic SMR-300 Safety, Security and Environmental Case Overview** – gives an overview of the main documents that constitute the SSEC.
- **Safety, Security and Environmental Case Structure** – identifies the structure of the Preliminary Safety Report (PSR), Preliminary Environmental Report (PER), Generic Security Report (GSR) [3] and Preliminary Safeguards Report (PSgR) [4] and summarises the content in each chapter.
- **Summary** and **References** – presents a summary of this chapter and the associated references.

[1] The SSEC also includes the Preliminary Safeguards Report (PSgR).

1.1.2 Fundamental Purpose of the SSEC

The SSEC for the generic SMR-300 consists of the PSR, the PER, GSR [3], PSgR [4] and their supporting documents. The complete set of SSEC documentation submitted for the GDA is captured within the Master Document Submission List (MDSL) [5]. Subchapter 1.3 covers the PSR, PER, GSR [3] and PSgR [4] in more detail. Figure 1 shows a visual representation of how the PSR, PER, GSR, PSgR and additional supporting documents form the SSEC.

Figure 1: Safety, Security and Environmental Case



Holtec Britain has developed the SSEC with a future licensee's legal duties in mind, so that it is fit for use as the starting point for a site-specific SSEC.

The Fundamental Purpose of the SSEC is to demonstrate that:

> *"The generic SMR-300 can be constructed, commissioned operated, and decommissioned on a generic site in the United Kingdom (UK) to fulfil the future licensee's legal duties to be safe, secure and protect people and the environment."*

The Fundamental Purpose is paramount and heads a 'golden thread' that flows throughout the SSEC. It can be achieved as a combination of the PSR Fundamental Objective (subchapter 1.3.1) together with the PER Fundamental Objective (subchapter 1.3.2) the GSR Fundamental Objective (subchapter 1.3.3) and the PSgR Fundamental Objective (subchapter 1.3.4).

The SSEC has been written for all stakeholders, the 'Stakeholders,' which include:

- The RP and its partners.
- The future licensee.
- The public.

- The Office for Nuclear Regulation (ONR), the Environment Agency (EA) and Natural Resources Wales (NRW).
- The UK Government.

Other stakeholders will be involved in the future (e.g., local authorities) when a specific site for the generic SMR-300 is chosen.

1.1.3 Scope

The SSEC has been developed for a twin-unit reactor design to be constructed, operated, and decommissioned on any generic site that is within the bounds of the generic SMR-300 Great Britain Generic Site Envelope (GB GSE).

The GDA for the generic SMR-300 is a two-step GDA, which is described in more detail in subchapter 1.2.

The GDA Scope consists of the operations that occur within the Nuclear Island (NI) plus the on-site fuel store, which includes the following buildings:

- Containment Enclosure Structure (CES).
- Containment Structure (CS).
- Reactor Auxiliary Building (RAB)[2].
- Intermediate Building (IB).
- Independent Spent Fuel Storage Installation (ISFSI).

PSR Part A Chapter 2 General Design Aspects and Site Characteristics [2] provides further detail on the GDA scope, including Structures, Systems and Components (SSCs) that are 'in-scope' and 'out-scope'. In addition, PSR Part A Chapter 2 provides more detail on the generic site description. This common chapter introduces the SMR-300 generic design, the reference design, and the generic site.

1.1.4 Requesting Party

The Requesting Party (RP) for the GDA is Holtec International. Holtec International has been a privately held company since its founding in 1986. A key subsidiary is Holtec Pallisades-LLC which is leading the licensing of SMR-300 in the United States (US) on behalf of Holtec International, for future deployment of this technology at the Palisades site.

Holtec International are also currently in the process of restarting a 800 MWe Nuclear Power Plant (NPP) at the Palisades site that was taken offline in 2022. Holtec International submitted a request to the US NRC in October 2023 to begin the reauthorisation of processes at Palisades and the work is still ongoing. Within the UK, Holtec International supported EDF at Sizewell B with provision of the dry store utilising the Multi-Purpose Canister (MPC) and the HI-STORM Mega-Impact Capable (MIC) casks.

The GDA is managed by Holtec Britain Ltd., a wholly owned UK subsidiary of Holtec International with Company Number 07396592. Holtec Britain have provided the Regulatory

[2] The radioactive waste handling and processing activities previously undertaken in the Radioactive Waste Building (RWB), have be transferred and incorporated within the design of the RAB.

Interface Office (RIO) and Project Management Office (PMO) including document controllers. All document transmittals from Holtec International to the UK regulators (and vice versa) have been passed through Holtec Britain.

The design for the generic SMR-300 originated in Holtec International and thus, Holtec International has the ultimate authority over the proposed design and associated design decisions. During the GDA process, prospective design changes to the DRP are managed through the 'Design Management Process' [6], further detail is provided within PSR Part A Chapter 4 [7].

Throughout the SSEC and its supporting documentation, the term 'Holtec' should be interpreted as referring to the RP, i.e. Holtec International.

1.1.4.1 Requesting Party Objective

Holtec wishes to gain regulatory confidence on the acceptability of a full plant design for GDA, such that it can be demonstrated that the generic SMR-300 can be constructed, commissioned, operated, and decommissioned on a generic site in the UK, and fulfil the future licensee's[3] legal duties to be safe, secure and protect people and the environment.

It is Holtec's intention to complete GDA Steps 1 (initiation) and 2 (fundamental assessment) of the UK GDA process with the objectives of:

- Fulfilling the fundamental assessment purpose of the SSEC.
- Improving confidence amongst stakeholders in the technology readiness for deployment and acceptability of the generic SMR-300.
- Reducing the project risk for the generic SMR-300 by engaging directly with stakeholders and providing clear, unambiguous evidence in support of the site-specific SSEC for the first twin-unit generic SMR-300 deployed in the UK.
- Designing, developing and building SMR-300s with a fleet mindset that weighs the risks against the lifecycle cost, trouble and time needed to control the risks of SMR-300 deployment across multiple sites worldwide, whilst ensuring fundamental safety and security of the design.

Holtec have undertaken only Step 1 and Step 2 of the GDA. Post Step 2, having gained a Step 2 GDA Statement, Holtec will support a prospective Nuclear Site Licensee to pursue statutory site licensing at the first site, further details are outlined within the Through-life SSEC Strategy [8]. The GDA process is described in more detail in subchapter 1.2.

1.1.5 Background to SMR-300

The SMR-300 is an advanced, Pressurised Water Reactor (PWR) NPP, incorporating two reactors in a single power plant layout, with a design informed by decades of operating reactor experience and industry lessons-learned, able to provide clean and affordable power with passive safety systems and improved safety compared to presently operating nuclear plants. The plant design specification is risk and value engineering informed, to facilitate a readily

[3] Throughout this report 'licensee' is used to refer to both the ONR Licensee and the EA Permit holder. Although the Licensee and the Permit Holder may differ, they are assumed to be the same within GDA.

licensable and competitive power plant product embodiment, planned for deployment both in the US and international markets.

An SMR-300 reactor is a two-loop PWR designed with forced circulation in normal operation, utilising two cold legs each with a vertically mounted Reactor Coolant Pump (RCP), two hot legs, and a single once-through Steam Generator (SGE) with an integral pressuriser stacked on top of the SGE. The plant design is simplified relative to operating plants and incorporates passive and robust safety systems to enhance its safety, construction, operation, and maintenance. The use of passive safety systems results in a highly reliable, safe design, which protects people and the plant. Additionally, the SMR-300 is designed to eliminate or simplify inspections, testing, and maintenance, which reduces operating costs.

1.1.5.1 Generic SMR-300 Plant Objectives

The primary objective of the generic SMR-300 design is to meet the applicable safety requirements and goals for advanced light water PWRs with passive safety features. The generic SMR-300 is designed to be compliant with applicable regulations and takes account of international regulatory frameworks and recommendations. Protection of the public health and safety, the environment, and that of plant workers is paramount.

The design of the generic SMR-300 is predicated on the following basic design principles and practices:

- Redundant and passive engineered safety features.
- Simplified plant design with structures designed to withstand postulated external events.
- Ability to mitigate design basis accidents with no operator action.
- Ability to cope with an extended loss of all alternating current (AC) power for 72 hours.
- Reliable active systems to support normal plant operation.

The generic SMR-300 design replaces features and equipment in existing light water PWR designs with improved, simplified and passively safe systems[4]. The simplification and reduction in equipment improves the reliability of the power and safety systems as well as reducing the cost of construction and plant maintenance. All safety systems, which mitigate design basis accidents, are also gravity driven without reliance on pumps, external water, or external power. The large volume annular water reservoir surrounds the containment structure and can provide passive cooling to the containment for more than three months in the case of an event by simple conduction and convection, followed by a transition to indefinite air cooling. No operator action is envisaged to mitigate events deemed to be credible for consideration in the safety analysis[5]. More detail on the evolution of the generic SMR-300 design and the reference design is provided in Chapter 2 ‘General Design Aspects and Site Characteristics’ [2].

[4] The actuation by battery power is categorised as a Category D Passive Safety System in IAEA TCS-69 [69].

[5] The in reactor Preliminary Fault Schedule produced within step 2 does not currently identify any operator actions. However, all faults have not yet been subject to Design Basis Accident Analysis within Step 2 of the GDA. Further details are provided in Part B Chapter 14.

1.1.5.2 Previous Pre-Licensing Studies

As part of the design development of the generic SMR-300, various pre-licensing studies have been undertaken by SMR-LLC.

- Vendor Design Review (VDR) is a high-level review of the conceptual design information against Canadian Nuclear Safety Commission (CNSC) requirements in three phases. VDR application for the CNSC was submitted and completed Phase 1 in 2020. The study provided useful LfE for the SMR project at that time.
- SMR-LLC began pre-licensing discussions with the US Nuclear Regulatory Commission (NRC) in July 2022. The pre-licence application allows pre-engagement with the NRC and public prior to formal licensing activities. The intention is to reduce the project risk by early identification of technical and policy issues. A pre-application readiness assessment has been produced for the SMR-300 in 2024, allowing a licensing strategy and programme to be developed for a commercial US application.

1.1.6 Design Reference Point

A reference design for the GDA is used as the basis for the PSR, PER, GSR [3] and PSgR [4], to ensure there is a consistent and coherent approach to the maturity of evidence against which the safety, security and environmental aspects of the SMR-300 plant are justified. It is normal practice for the reference design to continue to develop between each report, as changes will inevitably occur during the evolution of the design. The through life strategy for the generic SMR-300 is outlined within ‘SMR-300 Through-Life Safety, Security and Environmental Case (SSEC) Strategy’ [8] and PSR Part A Chapter 4 [7].

The DRP for the generic SMR-300 is presented in PSR Part A Chapter 2.

During the GDA process, prospective design changes to the DRP are managed through the ‘Design Management Process’ [6]. Design challenges and prospective design changes which are progressing through the Design Management Process are discussed within relevant Chapters of SSEC v1, with GDA Commitments raised as appropriate, where there is either further work required to resolve the challenge, or a potential design change has been identified. Commitments are captured within the Commitments, Assumptions and Requirements (CAR) register following the methodology outlined within ‘Capturing and Managing Commitments, Assumptions and Requirements’ [9] procedure.

The generic SMR-300 design development process is discussed further in PSR Part A Chapter 4 [7].

1.2 UK NUCLEAR REGULATORY REGIME AND GENERIC DESIGN ASSESSMENT

This chapter of the SSEC provides guidance on regulatory oversight of the safety case in the context of GDA, covering both the UK and US regulatory requirements. In addition to an overview of these regulatory requirements, an overview of the GDA process and compliances required by the ONR, the EA and NRW is also provided.

1.2.1 UK Nuclear Regulatory Regime

In accordance with the Fundamental Purpose, the SSEC has been produced with the UK nuclear, environmental safety, security and safeguards regulatory framework in mind. The following section identifies documentation that outlines the UK regulatory expectations to meet regulatory framework in support of a meaningful GDA. This framework includes, but is not limited to, the following acts and regulations of parliament:

- The Nuclear Installations Act 1965 [10].
- The Health and Safety at Work Act 1974 [11].
- The Energy Act 2023 [12].
- The Environment Act 1995 [13].
- The Environmental Permitting (England and Wales) Regulations 2016 (EPR16) [14].
- The Nuclear Industries Security Regulations (NISR) 2003 [15].
- The Nuclear Safeguards Regulations (EU Exit) 2019 [16].

The nuclear safety assessment (PSR) has been guided by the:

- ONR Site Licence Conditions [17].
- A Guide to Enabling Regulation [18].
- Licensing Nuclear Installations [19].
- ONR Safety Assessment Principles (SAPs) [20].
- ONR Technical Assessment Guides (TAGs).
- ONR Technical Inspection Guides (TIGs).
- ONR NNPPs Generic Design Assessment Guidance to Requesting Parties [21].
- ONR NNPPs: Generic Design Assessment Technical Guidance [22].

The PER[6] has been guided by the:

- New nuclear power plants: Generic Design Assessment Guidance for Requesting Parties [23].
- EA Radioactive Substances Regulations (RSR): Objective and Principles [24].
- EA RSR Generic Developed Principles: Regulatory Assessment [25].

[6] A large number of regulatory regimes apply to radioactive waste that apply to both the PSR and the PER, these are excluded from these lists for brevity but are reported in full within PSR Part B Chapter 13 [56] and PER Chapter 1 [37].

The GSR has been guided by the:

- ONR Security Assessment Principles (SyAPs) [26].
- ONR TAGs.
- ONR TIGs.
- ONR Generic Design Assessment Guidance to Requesting Parties [21].

The safeguards assessment (PSgR) has been guided by the:

- ONR Nuclear Material Accountancy, Control, and Safeguards (ONMACS) Assessment Principles [27].
- ONR TAGs
- ONR TIGs
- ONR NNPPs Generic Design Assessment Guidance to Requesting Parties [21].

Codes, standards, and methodologies appropriate to the design of the generic SMR-300 are summarised in Part A Chapter 2 of the PSR [2] and in each chapter within Part B of the PSR, and within the PER, GSR [3] and PSgR [4].

The GDA process and the specific guidance is discussed in the next subchapter.

1.2.2 US Nuclear Regulatory Framework

The US regulatory system enforced by the US NRC is relatively prescriptive but contains elements that are goal setting and risk informed. The notion of reasonable practicability, expressed by the risk ALARP principle, is captured for dose control through the As Low As Reasonably Achievable (ALARA) concept which demonstrates that there are synergies of detail even if not of overall concept between the regimes. Moreover, both UK and US systems are consistent with the requirements and guidance of the International Atomic Energy Agency (IAEA).

A major difference in regulatory approach is that the UK Government has established the risk ALARP principle in statute and it drives much of the ONR regulatory process as it applies to safety cases, including the non-prescriptive, technology neutral approach. The NRC by contrast, starts off with a number of high-level design principles or LWR specific General Design Criteria (GDC) [28], and these are supported by prescriptive regulatory guidance.

A second major difference is that the NRC specifies in this guidance the design codes and standards that must be used, although exceptions are permitted subject to justification, whereas the ONR leave it to the RP/Licensee to select and justify what it terms RGP. Endorsed codes, together with the versions of the codes (which may not be the latest versions) are promulgated through NUREG-0800 [29]. This requires NRC to have substantial engagement with code committees and the development of individual codes.

An advantage to the US industry is that these codes are automatically well matched to the NRC regulatory approach, and in many cases, written specifically to respond to NRC regulatory concerns. A disadvantage to the UK industry, and to US designs moving into the UK, is that these US codes do not necessarily reflect UK nuclear practice, especially the use of the risk ALARP principle. Nevertheless, US codes are used extensively around the world, including in the UK and therefore Holtec consider them to represent good practice, that is

relevant to the deployment of the SMR-300 in the UK. More detailed justification for this is provided in PSR Part A Chapter 2 and in individual PSR Part B Chapters where relevant.

1.2.3 GDA Process

GDA is intended to offer a number of advantages for both the regulators (ONR, and the EA and NRW) and the RP. The objective is to provide confidence that the proposed design is capable of being constructed, operated, and decommissioned in accordance with the required standards of safety, security, safeguards and environmental protection. For the RP, this offers a reduction in uncertainty and project risk regarding the design and SSEC, to enable future licensing, permitting, construction and regulatory activities.

The GDA process for the generic SMR-300 consists of the following two steps:

- Step 1 is the initiation, where matters such as the scope and timescales are agreed, and ONR's knowledge of the design and the RP's safety, security and safeguards cases increases. Importantly, this Step includes the RP identifying any immediate gaps in meeting regulatory expectations and proposing how these are to be subsequently resolved.
- Step 2 is the fundamental assessment of the generic safety, security and safeguard cases, to identify any potential 'showstoppers' that may preclude deployment of the design.

The current ONR guidance to RPs ONR-GDA-GD-006 [21], ONR-GDA-GD-007 [22] and EA/NRW GDA guidance to RPs [23] has been produced for all future GDA activities. Section 2 Table 2 of ONR-GDA-GD-006 [21] suggests several different approaches to the GDA that the RP may wish to consider, dependent on the design maturity. Holtec believe that at the point of commencing Step 2 GDA, the generic SMR-300 was equivalent to a 'conceptual full plant design' from this table. Therefore, a two-step GDA culminating in a GDA Statement would be the appropriate outcome to gain regulatory confidence in the acceptability of a full plant design.

Holtec, as the RP, considers there to be high value and meaning in undertaking the two-step GDA process. 'Meaningful' in the context of a two-step GDA, is interpreted by Holtec (and in alignment with GDA guidance) to encompass that:

- The design and SSEC are sufficiently mature, to ensure that the risk of UK regulators becoming involved in the RP's design process is minimised.
- The two-step GDA process enables the RP to seek regulatory confidence on the acceptability of a full plant design, but where the design and substantiation are not yet mature enough to complete a detailed assessment. Essentially an opportunity to identify if there are any potential 'showstoppers'.
- All the safety, security, safeguards, and environmental justifications for the full design are not expected, but that significant supporting safety analysis and design justifications would still be required, to understand the nuclear safety, security, safeguards and environmental implications and interfaces of the systems, structures, and components.

At the end of Step 2, following ONR assessment, a GDA Statement will reflect the agreed GDA scope and the assessment to that point in time, in the context of the objectives for ONR's

assessment during that Step. It will provide an indication of confidence, based upon the assessment conducted to date, on EA, NRW and the ONR's judgement of whether the design is potentially capable of being built and operated on a site bounded by the generic site envelope, in a way that is safe and secure.

The Step 2 GDA Statements will clearly identify areas where future regulatory scrutiny will be necessary to achieve a Design Acceptance Certificate (DAC) and Statement of Design Acceptability (SoDA), that being the objective of the three-step GDA process.

1.2.4 GDA Compliance

The current ONR guidance to RPs ONR-GDA-GD-006 [21], ONR-GDA-GD-007 [22] and EA/NRW GDA guidance to RPs [23] has been produced for all future GDA activities. In addition to incorporating the latest lessons learnt, it considers the changes in the nuclear industry in the decade since GDA was devised. A number of improvements have been made to enhance the efficiency and flexibility of the GDA process, whilst maintaining the exacting standards of safety, security and environmental protection achieved previously and the robustness of the regulatory decision making.

The GDA guidance reflects lessons learnt by ONR, EA and NRW during its past GDA work related to the RP's safety, security and environmental case production.

From the ONR perspective, the Tables in Appendix 2 to 4 of ONR-GDA-GD-006 [21] and technical assessment topic guidance in ONR-GDA-GD-007 [22] are a key part of the guidance for the PSR, GSR and PSgR. They summarise ONR's requirements for each of the GDA steps to allow the RP to become familiar with these before entering and throughout any GDA. This gives the RP the greatest opportunity to provide quality documentation that meets these expectations in a timely manner.

The regulatory expectations and requirements for the environmental case for the whole GDA process are set out in GDA guidance 'New Nuclear Power Plants: Generic Design Assessment Guidance for Requesting Parties [23]'. The guidance covers the following eight aspects:

- General information about the RP and the design.
- Description of the RP's management arrangements and responsibilities.
- Detailed information about the design.
- Detailed description of radioactive waste management arrangements.
- Quantification of radioactive waste disposals.
- Sampling arrangements, techniques, and systems for measuring and assessing discharges and disposals of radioactive waste.
- Prospective radiological assessment at the proposed limits for discharges and for any on-site incineration.
- Information relating to other environmental regulations.

The RP has considered the above general guidance, along with the supporting technical guidance described in subchapter 1.2.1.

EA/NRW

- RSR principles: Radioactive Substances Management Developed Principles (RSMDP) [30], Radiological Protection Developed Principles (RPDP) [31], and Decommissioning Developed Principles (DEDP) [32], etc.

During the GDA process, before an RSR permit is authorised and in place, potential permit applicants and proposed nuclear facilities can utilise the RSR: Objective and Principles [24] and RSR: Generic Developed Principles [25] documents which underpin the permit conditions within the RSR permits. Relevant RSR principles have been considered and addressed appropriately to develop a PER commensurate with Holtec's GDA scope [33].

ONR

- ONR-GDA-GD-006 [21], ONR-GDA-GD-007 [22], ONR Security Assessment Principles (SyAPs) [26], ONR Nuclear Material Accountancy, Control, and Safeguards (ONMACS) Assessment Principles [27], the SAPs [26], ONR TIGs and TAGs, notably TAG NS-TAST-GD-051 [34] on "The Purpose, Scope and Content of Nuclear Safety Cases" and the Site Licence Conditions [17] have all been used to support the development of the Step 2 GDA SSEC.

Where applicable, basic compliance with these requirements has been highlighted in the SSEC Structure in subchapter 1.4. Further details regarding the relevant codes and standards are provided within each chapter of the relevant SSEC documents.

1.3 SAFETY, SECURITY AND ENVIRONMENTAL CASE OVERVIEW

This subchapter provides an overview of the SSEC and the individual submissions: the PSR, the PER the GSR [3] and the PSgR [4]. The Fundamental Purpose of the SSEC is stated in subchapter 1.1.2. It can be achieved as a product of the PSR Fundamental Objective (subchapter 1.3.1) together with the PER Fundamental Objective (subchapter 1.3.2), GSR Fundamental objective (subchapter 1.3.3) and the PSgR Fundamental Objective (subchapter 1.3.4). This is visualised in a simple hierarchy in Figure 2.

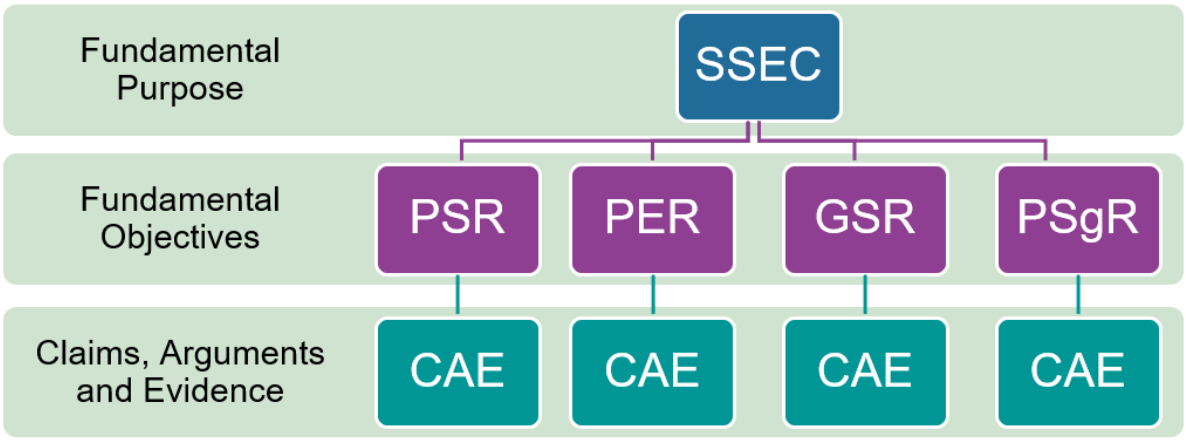


Figure 2: The Fundamental Purpose, Objective and CAE Hierarchy

The fundamental objectives then diverge to the individual overarching claims, which have sub-claims, arguments and evidence trails in the respective chapters of each report that forms the SSEC.

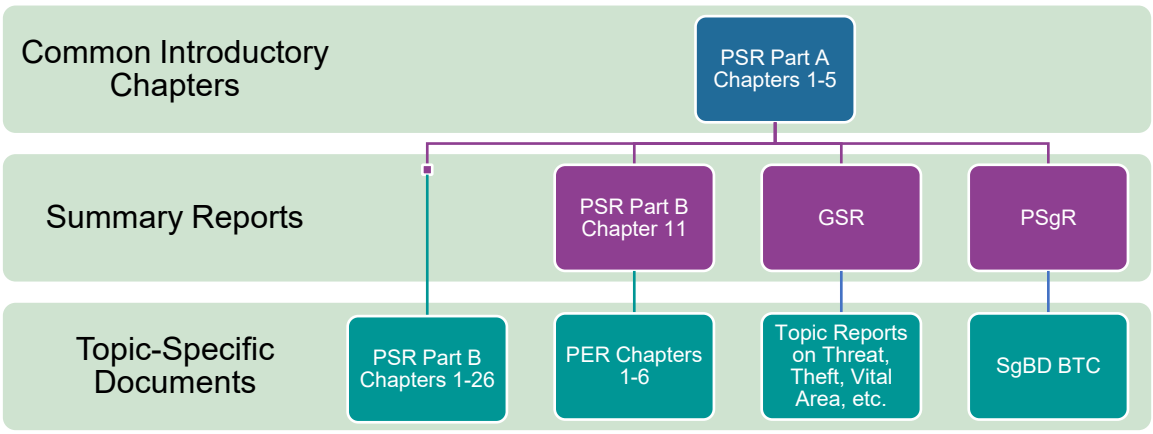


Figure 3: The SSEC Documentation Structure

The introductory chapter is common across the PSR, PER, GSR and PSgR submissions. The subchapters below expand on Figure 3.

1.3.1 Holtec GDA PSR

Holtec is required to provide ONR with a safety case for the NPP design under scrutiny to enable ONR's assessment and at the end of Step 2, a GDA Statement. This obligation is fulfilled by the PSR.

- **PSR Fundamental Objective**: The PSR summarises the safety standards and criteria, safety management and organisation, claims, arguments and intended evidence to demonstrate that the risks to people from the generic SMR-300 design will be tolerable and ALARP.

The Holtec GDA PSR relates to the nuclear safety and radioactive waste management aspects of the safety case and is focussed on fulfilling the scope described in subchapter 1.1.3 for the GDA process identified in subchapter 1.2. It has been split into two parts with distinct chapters.

1.3.1.1 PSR Part A

PSR Part A is a summary of the safety case for the generic SMR-300. Chapter 2 General Design Aspects and Site Characteristics of the PSR [2] describes the characteristics of the generic site used in the design and the key safety claims, safety and design principles, and codes and standards. The overarching claims architecture used across the PSR is set out in Part A Chapter 3 of the PSR 'Claims, Arguments and Evidence'. Lifecycle aspects of Management for Safety and Quality Assurance (MSQA) in PSR Part A Chapter 4 [7] explains the quality arrangements, project arrangements, design process and safety case management framework against which the SMR-300 is being developed. This chapter also provides a summary of the processes by which GDA commitments are being managed. Part A Chapter 5 'Summary of ALARP and SSEC' [35] provides an overview as to why the activities that the safety report seeks to justify can be safely undertaken, with no further reasonably practicable risk reduction measures available. This includes a summary of the evaluation of the risks involved with the activities. This chapter also provides a summary of any significant GDA commitments identified across the PSR.

1.3.1.2 PSR Part B

PSR Part B is focuses on the reactor design and its safety assessment and is structured according to the GDA topic areas where specific details are required. Chapters B1-B6[7] are a description of the design and main operating systems. Chapters B9-B13 describe normal operational aspects of the reactor. Chapters B14-B16 are focussed on the safety assessment undertaken for the SMR design highlighting the fault identification process, the potential faults and accidents and demonstrating appropriate defence in depth in design. Part B Chapter 14 'Design Basis Accident Analysis' [36] contains the preliminary fault schedule for the PSR and outlines the differences in the approach to safety categorisation and classification between the NRC regulatory guides and the UK expectations are outlined and a methodology outlined. Chapters B17 – B26 are focussed on specific topic areas, such as Human Factors, Structural Integrity and Hazards giving more details that are relevant for the topic.

[7] PSR Part B Chapters 3, 7 and 8 are unused within the current PSR at Revision 1.

The contents of Part A and Part B of the GDA PSR are expanded in Table 1 and Table 2, which provides a structure and gives clarity to the safety case architecture and hierarchy of documentation.

1.3.2 Holtec GDA PER

The PER works together with relevant parts of PSR to form a robust environment case, which aims to support the SSEC Fundamental Purpose:

- **PER Fundamental Objective**: The PER presents the environmental standards, criteria, and management arrangements to provide confidence that the design, construction, operation and decommissioning of the generic SMR-300 will protect people and the environment from harm and will apply Best Available Techniques (BAT) and incorporate relevant good practice and operating experience.

It is recognised that the starting point of EA's assessment for environment case is the information provided by the RP. The GDA guidance [23] outlines requested information that the RP should prepare during Step 1 for EA's assessment in GDA Step 2. In line with these regulatory requirements, the PER comprises six separate chapters:

- PER Chapter 1: Radioactive Waste Management Arrangements [37].
- PER Chapter 2: Quantification of Effluent Discharges and Limits [38].
- PER Chapter 3: Radiological Impact Assessment [39].
- PER Chapter 4: Conventional Impact Assessment [40].
- PER Chapter 5: Monitoring and Sampling [41].
- PER Chapter 6: Demonstration of BAT [42].

There is an interface between PSR Part B Chapter 13 of the PSR and the PER via PER Chapter 6, as this is where the environmental focused claims are held. These claims cover environmental protection-based aspects of the generic SMR-300 including radioactive waste management. In addition, PSR Part B Chapter 13 interfaces heavily with PER Chapter 1. This PER chapter addresses specifically the EA's expectations with respect to the management of radioactive waste while the PSR addresses the ONR's. Notwithstanding, there is an integrated approach between these chapters to ensure that all regulators are suitably satisfied that a holistic demonstration of safe management of radioactive waste is made across the SSEC.

1.3.3 Holtec GDA GSR

The Holtec GDA GSR [3] relates to the nuclear security aspects of the SSEC which aims to support the SSEC Fundamental Purpose:

- **GSR Fundamental Objective**: Security risks are managed to protect workers and the public from a radiological event arising from the theft or sabotage of nuclear or radioactive material (or supporting systems) or through the compromise of sensitive nuclear information (SNI).

The generic SMR-300 GDA Step 2 nuclear security submission is focused on the methodologies, approaches, codes, standards, and philosophies, which together form the building blocks for the development of the site security case and site security arrangements/security plan.

Step 2 includes an illustration of the implementation of the methodologies which road-tests the different aspects of the nuclear security case to build confidence that they are suitable and sufficient for use in subsequent project stages. This will assist ONR in their assessment that the methodologies proposed are adequate and, if implemented by a site licensee, would lead to a generic SMR-300 design compliant with legislative and regulatory requirements.

The GSR [3] forms a head document at 'claims' level and presents the nuclear security case. Two versions of this head document are produced in Step 2 to enable the GSR to be subject to public comments. The public version requires the redaction of security classified information. The GSR is supported by several 'Tier 2' Topic Reports. These document the methodologies and their GDA implementation in order to facilitate the illustration of the golden thread from the security fundamental objective to the conceptual security arrangements.

1.3.4 Holtec GDA PSgR

The Holtec GDA PSgR [4] relates to the safeguards aspects of the SSEC.

- **PSgR Fundamental Objective**: The UK generic SMR-300 Safeguards programme will support the delivery of the UK's obligations under the Voluntary Offer Agreement (VOA) and Additional Protocol (AP).

Meeting this objective requires that:

- The undeclared withdrawal of a Significant Quantity (SQ) of Qualifying Nuclear Material (QNM) from the SMR-300 site will be detected in a timely manner in accordance with the VOA.
- The SMR-300 operator will provide the reporting required by the AP.

The aim of the generic SMR-300 GDA Step 2 safeguards submission is to demonstrate to the ONR that Safeguards by Design (SgBD) is being implemented in the evolving generic design of SMR-300, that safeguards is informing the design and layout, and that the UK safeguards regulatory framework and expectations are being accommodated. In particular, it presents:

- Holtec's understanding of the safeguards requirement at the generic (international and UK domestic) level and Relevant Good Practice (RGP).
- An outline at a high level of the SMR-300 safeguards programme, i.e. how the safeguards requirements will be delivered for the SMR-300 through all phases of its lifecycle, and progress in its implementation during Step 2.
- An outline of the SMR-300 safeguards case and the main safeguards claims, showing how these claims integrate with the SMR-300 SSEC, and progress on the development of the safeguards case.
- The basis for the accommodation of the safeguards requirement in the generic SMR-300 design, including information on the development of the safeguards design objective and safeguards design principles, and progress in the implementation of SgBD.
- Progress on the development of conceptual safeguards arrangements, including QNM flow, Material Balance Areas and Key Measurement Points.
- An outline of the evolution from GDA Step 2 to site licensing in the safeguards area, in accordance with the SMR-300 safeguards programme.

The PSgR is complemented by the first issue of the generic SMR-300 SgBD Basic Technical Characteristics (BTC) [43] to support engagement with ONR. This is an informal issue of the BTC, noting that the first formal submission is not required until the decision to construct at a specific site is taken.

1.3.5 GDA Documentation

Documentation supporting the PSR, PER, GSR [3] and the PSgR [4] for the GDA submission includes various design documents, descriptions, and methodologies. This information is captured in the MDSL [5] to form the SSEC and the complete GDA submission.

1.3.5.1 Master Document Submission List

The MDSL [5] contains the latest revision of each submission made by the RP and is updated during the GDA process to reflect any additional work. It allows the stakeholders to track documents submitted and any subsequent changes to these documents, including documents withdrawn, such that it provides an auditable trail through the SSEC.

Documents listed in the MDSL are generally linked to the SSEC submission (Tier 1), as illustrated in Figure 4 and discussed further in Section 1.3.5. Documents not submitted for assessment are excluded from the MDSL.

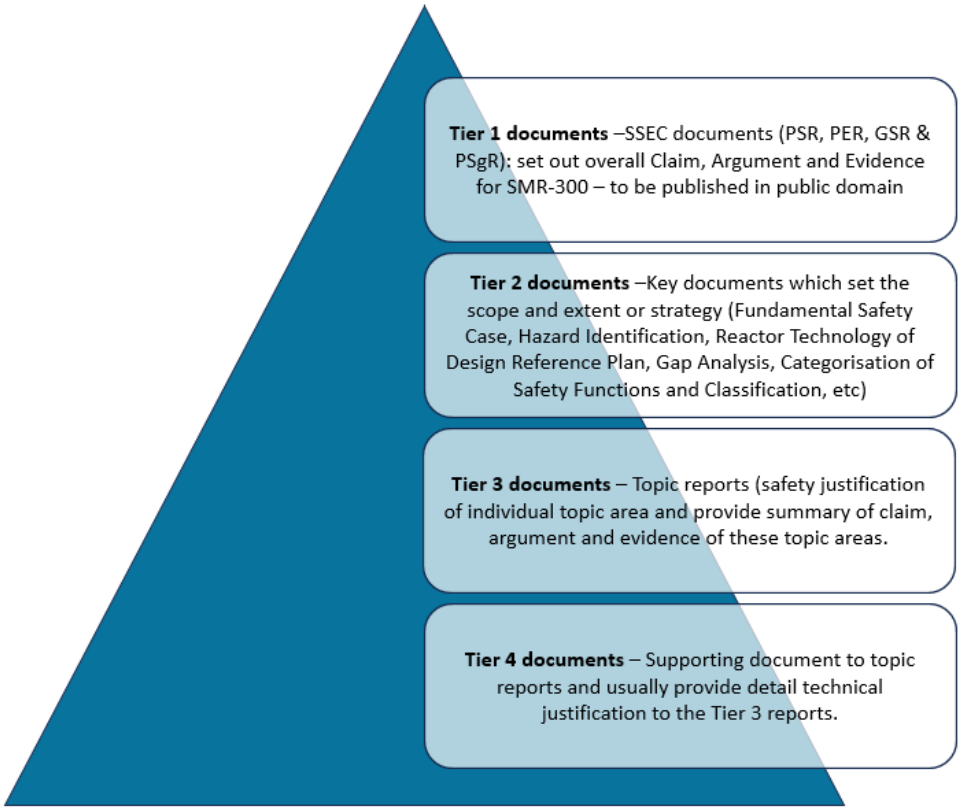


Figure 4: Tiered Document Structure for GDA

1.3.5.2 GDA Document Structure

Documentation submitted to support the GDA comprises of four discrete tiers. Tier 2 and Tier 3 are generally referenced directly from Tier 1. Tier 4 documents are usually supporting references to Tier 3 and not normally referenced from Tier 1:

- Tier 1: SSEC documents that set out the overall CAE for the generic SMR-300.
- Tier 2: Fundamental design documents that set the scope and strategy (e.g., fundamental safety case, design reference plant and gap analysis etc.).
- Tier 3: Topic reports that justify the safety in an individual topic area.
- Tier 4: Supporting documents to topic reports providing detailed technical justifications.

The MDSL [5] is periodically updated and delivered to the regulators and will be updated at the end of the Step 2 GDA to capture the complete GDA submission documentation at the relevant revision.

1.3.6 Safety, Security and Environmental Case Delivery

This subchapter presents the high-level programme for the delivery of the SSEC submissions, further detail can be found within PSR Part A Chapter 4 ‘Lifecycle Management of Safety and Quality Assurance’ [7].

The overarching management arrangements for the GDA process and generic SMR-300 are set out in the Holtec SMR-300 Generic Design Assessment Project Management Plan [44] and Holtec SMR-300 Generic Design Assessment Project Quality Plan [45]. PSR Part A Chapter 4 ‘Lifecycle Management of Safety and Quality Assurance’ [7] covers the activities undertaken to manage production of the SSEC (PSR, PER, GSR and the PSgR reports), which covers:

- Development of the scope, strategy and specification of the SSEC.
- Authoring of the SSEC.
- Review of the SSEC.
- Approval of the SSEC.
- Identification and management of GDA Commitments arising from the SSEC.

The ‘Through-Life Safety, Security and Environmental Case (SSEC) Strategy’ [8] outlines the proposed approach to managing the SSEC and DRP throughout the lifetime of the SSEC, including design updates and project phases.

The production of supporting Tier 2 and Tier 3 information has been undertaken during the Step 2 period, which support the SSEC at Revision 1.

1.4 SAFETY, SECURITY AND ENVIRONMENTAL CASE STRUCTURE

To achieve the Fundamental Purpose of the SSEC, Holtec has considered the GDA guidance identified in subchapter 1.2.4. The chapter structure of the PSR is given in Table 1 and Table 2. A brief description of the chapter contents is given alongside each subchapter heading. Applicability of Step 2 requirements presented in ONR-GDA-GD-006, Guidance to Requesting Parties on the Generic Design Assessment (GDA) process for safety and security assessments of new Nuclear Power Plans (NPP) [21] to the PSR chapters has also been highlighted in Table 1 and Table 2, subchapter 1.2.4 outlines the link to ONR guidance.

Similarly, for the PER, the chapter structure is given in Table 3 where a brief description of the chapter contents is given alongside each subchapter heading. Applicability of Step 2 requirements presented in New nuclear power plants: Generic Design Assessment guidance for Requesting Parties [23] to the PER chapters has also been highlighted in Table 3, subchapter 1.2.4 outlined the link to EA/NRW guidance. PER Chapter 6 [42] has been produced that demonstrates BAT for the design, commissioning, operation and decommissioning of the generic SMR-300, responding to the specific GDA guidance on BAT demonstration. This report structure is presented in Table 3.

The GSR structure is presented in Table 4. A brief description of the report contents is given in the table. Applicability of Step 2 requirements presented in [21] to the GSR has also been highlighted in Table 4

The PSgR structure is outlined in Table 5.

Table 1: PSR Part A Chapter Structure and Applicability of ONR Step 2 Requirements

Chapter Number	Chapter Title	Chapter Content	ONR GDA Guidance to RPs [21] Appendix 3 Step 2 Requirement
1	Part A Chapter 1 Introduction		
1.1	Introduction	This chapter is a generic introduction to the generic SMR-300 GDA process and the SSEC. It is common across the PSR, PER, GSR and the PSgR.	Requirement [2.1] Requirement [2.2] Requirement [2.11] Requirement [2.12] Requirement [2.14] Requirement [2.15]
1.2	UK Nuclear Regulatory Regime and Generic Design Assessment		
1.3	Safety, Security and Environmental Case Overview		
1.4	Safety, Security, Safeguards and Environmental Case Structure		
1.5	Summary		
1.6	References		
2	Part A Chapter 2 General Design Aspects and Site Characteristics [2]		
2.1	Introduction	This chapter is an introduction to the generic SMR-300 generic design, the reference design, and the generic site. It also introduces the design principles, main codes and standards of design and the categorisation and classification methodology. It is common across the PSR, PER, GSR and the PSgR and contains the master list of acronyms used across the SSEC. Note: This chapter is also developed to respond to EA/NRW GDA requirements, including the plant and process descriptions, the descriptions of the generic site, design strategies/ methods/models/standards, and the considerations of climate change adaptation in the design.	Requirement [2.3] Requirement [2.5] Requirement [2.6] Requirement [2.8] Requirement [2.9] Requirement [2.11] Requirement [2.15] Requirement [2.16]
2.2	US Reference SMR-300 Plant Development		
2.3	US Reference SMR-300 Plant Description		
2.4	Generic SMR-300 GDA Design Scope		
2.5	General Design Aspects and Site Characteristics Claims, Arguments and Evidence		
2.6	US SMR-300 Reference Plant Safety and Design Principles		
2.7	UK Approach to Safety Demonstration for the Generic SMR-300		
2.8	Generic Site Envelope		
2.9	Chapter Summary and Contribution to ALARP		
2.10	References		
2.11	List of Appendices		

Chapter Number	Chapter Title	Chapter Content	ONR GDA Guidance to RPs [21] Appendix 3 Step 2 Requirement
3	Part A Chapter 3 Claims, Arguments and Evidence [46]		
3.1	Introduction	This chapter is an introduction to the generic SMR-300 CAE process. It links the CAE process to the structure of the safety case and the CAE made across the SSEC. By doing so it highlights the golden thread and safety case reasoning.	Requirement [2.6] Requirements [2.11]
3.2	Codes, Standards and Methodology		
3.3	CAE Trail		
3.4	Summary and Commitments		
3.5	References		
3.6	List of Appendices		
4	Part A Chapter 4 Lifecycle Management of Safety and Quality Assurance [7]		
4.1	Introduction	This chapter addresses the key MSQA aspects related to the lifecycle of the generic SMR-300. It describes the overarching Holtec's MSQA arrangements, which are cascaded down into the SMR-300 design development, GDA and post- GDA processes. It details the specific MSQA processes applied during the GDA for the development of the nuclear and conventional safety, and environment and security cases. Additionally, it supports the lifecycle elements of the ALARP demonstration, with respect to MSQA, for the construction, commissioning, operation and decommissioning of the SMR-300. The MSQA aspects covered in the chapter apply across the PSR, PER, GSR and the PSgR.	Requirement [2.3] Requirement [2.4] Requirement [2.12] Requirement [2.13] Requirement [2.15] Requirement [2.17] Requirement [2.18] Requirement [2.19] Requirement [2.22]
4.2	Overview of Holtec Lifecycle MSQA		
4.3	Lifecycle MSQA Claims, Arguments, Evidence Overview		
4.4	Lifecycle MSQA Codes, Standards / Methodology		
4.5	Holtec Quality Management Arrangements		
4.6	Holtec Project Management Arrangements		
4.7	Holtec Design Management Arrangements		
4.8	Holtec SSEC Management Arrangements		
4.9	Holtec Arrangements for Future Lifecycle Phases		
4.10	Chapter Summary and Contribution to ALARP		
4.11	References		
4.12	List of Appendices		
5	Part A Chapter 5 Summary of ALARP and SSEC [35]		
5.1	Introduction	This chapter aims to summarise the PSR and conclude whether the PSR Fundamental Objective has been met. It draws together the outcomes of the PSR,	Requirement [2.17] Requirement [2.14]
5.2	Overview of The ALARP Principle		

Chapter Number	Chapter Title	Chapter Content	ONR GDA Guidance to RPs [21] Appendix 3 Step 2 Requirement
5.3	ALARP Claims, Arguments and Evidence Overview	PER GSR and PSgR against their objectives to demonstrate that the Fundamental Purpose of the SSEC has been met. This chapter provides an overview as to why the activities that the safety report seeks to justify can be safely undertaken, with no further reasonably practicable risk reduction measures available. This includes a summary of the evaluation of the risks involved with the activities.	Requirement [2.12] Requirement [2.13]
5.4	Adoption of Relevant Good Practice		
5.5	Design Development and Consideration of ALARP		
5.6	Tolerability of Risk		
5.7	Options Considered to Further Reduce Risk		
5.8	Conclusion on the Fundamental Objective of the PSR		
5.9	Conclusion on the Fundamental Objectives of the PER, GSR and PSgR		
5.10	Overall SSEC Conclusion on the Fundamental Purpose		
5.11	References		
5.12	List of Appendices		

Table 2: PSR Part B Chapter Structure and Applicability of ONR Step 2 Requirements

Chapter Number	Chapter Title	Chapter Content	ONR GDA Guidance to RPs [21] Appendix 3 Step 2 Requirements
1	Part B Chapter 1 Reactor Coolant System and Engineered Safety Features [47]		
1.1	Introduction	This chapter is a description of the Reactor Coolant Systems (RCS) and the main Engineered Safety Features (ESF). It focusses on the codes, standards and the methodology used in design of these Structures, Systems, and Components (SSC), what specific CAE is related to them and any improvements that have been made or are yet to be made in the interests of reducing risks to ALARP.	Requirement [2.4] Requirement [2.6] Requirement [2.11]
1.2	Overview of Plant Systems		
1.3	RCS and ESFs Claims, Arguments, Evidence		
1.4	RCS and ESFs Codes and Standards		
1.5	Reactor Coolant System		
1.6	Engineered Safety Features		

Chapter Number	Chapter Title	Chapter Content	ONR GDA Guidance to RPs [21] Appendix 3 Step 2 Requirements
1.7	Chapter Summary and Contribution to ALARP		
1.8	References		
1.9	List of Appendices		
2	Part B Chapter 2 Reactor [48]		
2.1	Introduction	This chapter is a description of the reactor fuel and core. It focusses on the codes, standards and the methodology used in design of these SSCs, what specific CAE is related to them and any improvements that have been made or are yet to be made in the interests of reducing risks to ALARP.	
2.2	Reactor Overview		
2.3	Reactor Operation		
2.4	Reactor Claims, Arguments and Evidence		
2.5	Reactor Codes and Standards / Methodologies		
2.6	Reactor Safety Case Overview		
2.7	Reactor Safety Case Assessment		
2.8	Chapter Summary and Contribution to ALARP		
2.9	References		
2.10	List of Appendices		
3	Part B Chapter 3 Engineered Safety Features – Chapter Not Used - Reserved for Future Safety Cases. Information Incorporated into PSR Part B Chapter 1		
4	Part B Chapter 4 Control & Instrumentation (I&C) [49]		
4.1	Introduction	This chapter is a description of the main I&C systems used for reactor operation and protection. It focusses on the codes, standards and the methodology used in design of these SSCs, what specific CAE is related to them and any improvements that have been made or are yet to be made in the interests of reducing risks to ALARP.	Requirement [2.4] Requirement [2.6] Requirement [2.11]
4.2	Description of I&C SSCs		
4.3	I&C Claims, Arguments, Evidence		
4.4	I&C Codes, Standards and Methodologies		
4.5	Defence in Depth		
4.6	Quality Manufacturing and Installation Processes		
4.7	Examination, Inspection, Maintenance, and Testing		
4.8	Chapter Summary and Contribution to ALARP		

Chapter Number	Chapter Title	Chapter Content	ONR GDA Guidance to RPs [21] Appendix 3 Step 2 Requirements
4.9	References		
4.10	List of Appendices		
5	Part B Chapter 5 Reactor Supporting Facilities [50]		
5.1	Introduction	This chapter is a description of the auxiliary and steam and power conversion systems. It focusses on the codes, standards and the methodology used in design of these SSCs, what specific CAE is related to them and any improvements that have been made or are yet to be made in the interests of reducing risks to ALARP.	Requirement [2.4] Requirement [2.6] Requirement [2.11]
5.2	Overview of Reactor Supporting Facilities		
5.3	Reactor Supporting Facilities Claims, Arguments and Evidence		
5.4	Reactor Supporting Facilities Codes and Standards		
5.5	Auxiliary Systems		
5.6	Steam and Power Conversion Systems		
5.7	Mechanical Handling Systems		
5.8	Heating, Ventilation and Air Conditioning Systems		
5.9	HVAC System Architecture		
5.10	Chapter Summary and Contribution to ALARP		
5.11	References		
5.10	List of Appendices		
6	Part B Chapter 6 Electrical Engineering [51]		
6.1	Introduction	This chapter presents the safety case for electrical systems within the plant and how the design supports the higher-level safety claims. It presents the codes, standards and the methodology used in design of these SSCs, what specific CAE is related to them and any improvements that have been made or are yet to be made in the interests of reducing risks to ALARP. In addition, it includes a subchapter discussing Adaption to the UK Grid which	Requirement [2.4] Requirement [2.6] Requirement [2.11]
6.2	Description of Electrical Engineering SSCs		
6.3	Electrical Engineering Claims, Arguments and Evidence		
6.4	Electrical Engineering Codes and Standards		
6.5	Electrical Engineering Architecture		
6.6	Adaption to UK Grid		
6.7	UK Electrical Diplomat Impacts		

Chapter Number	Chapter Title	Chapter Content	ONR GDA Guidance to RPs [21] Appendix 3 Step 2 Requirements
6.8	Quality Manufacturing and Installation Processes	contains sub-sections on Grid Code Compliance and 60/50Hz.	
6.9	Verification, Validation and EIMT		
6.10	Chapter Summary and Contribution to ALARP		
6.11	References		
6.12	List of Appendices		
7	Part B Chapter 7 Auxiliary Systems – Chapter Not Used - Reserved for Future Safety Cases. Information Incorporated into PSR Part B Chapter 5.		
8	Chapter Not Used - Reserved for Future Safety Cases.		
9	Part B Chapter 9 Conduct of Operations [52]		
9.1	Introduction	This chapter is a description of the high-level operational philosophy and the Main Control Room, including limits and conditions of operation, operating documentation the approach to Examination, Inspection, Maintenance and Testing (EIMT) and ageing effects.	Requirement [2.4] Requirement [2.6] Requirement [2.11]
9.2	Overview of Operational Aspects and Conduct of Operations		
9.3	Normal Operations Claims, Arguments and Evidence		
9.4	Conduct of Operations Codes and Standards / Methodologies		
9.5	Main Control Room and Remote Shutdown Facility		
9.6	Operating Limits and Conditions		
9.7	Operating Procedures		
9.8	Examination, Inspection, Maintenance and Testing		
9.9	Chapter Summary and Contribution to ALARP		
9.10	References		
9.11	List of Appendices		
10	Part B Chapter 10 Radiological Protection [53]		
10.1	Introduction	This chapter is a description of the radiological protection engineered features of the reactor, including the radiological protection measures in place for all the operating modes demonstrating	Requirement [2.4] Requirement [2.6] Requirement [2.11]
10.2	Source Term		
10.3	Description of Radiological Protection SSCs		

Chapter Number	Chapter Title	Chapter Content	ONR GDA Guidance to RPs [21] Appendix 3 Step 2 Requirements
10.4	Radiological Protection Claims, Arguments and Evidence	the hierarchy of controls. It presents the design requirements for dose optimisation and strategy used within the design to achieve them. Also included are the codes, standards and the methodology used in design of these SSC, what specific CAE is related to them and any improvements that have been made or are yet to be made in the interests of reducing risks and dose to ALARP.	
10.5	Radiological Protection Codes, Standards and Methodologies		
10.6	Radiological Protection Requirements		
10.7	Design for Radiological Protection		
10.8	Chapter Summary and Contribution to ALARP		
10.9	References		
10.10	List of Appendices		
11	Part B Chapter 11 Environmental Protection [54]		
11.1	Introduction	This chapter summarises the environment case (PER chapters 1 through 6) and describes how the environmental Fundamental Objects are met within the GDA. The contents of the PER chapters is outlined further in Table 3.	Requirement [2.6] Requirement [2.11]
11.2	Claims, Arguments and Evidence		
11.3	Environmental Legislation and Policy		
11.4	Environmental Impacts of SMR-300		
11.5	References		
11.6	List of Appendices		
12	Part B Chapter 12 Nuclear Site Health and Safety and Conventional Fire Safety [55]		
12.1	Introduction	This chapter is a description of both the Nuclear Site Health and safety and the Conventional Fire Safety topic areas. Nuclear Site Health and Safety covers the strategies and procedures in to ensure that the SMR-300 is safe by design. Also included are the codes, standards and the methodology used in UK design safety management, what specific CAE is related to them and any improvements that have been made or are yet to be made in the interests of reducing risks to ALARP. Conventional Fire Safety covers the production of a high-level fire strategy that can likely be developed further post GDA without major changes to the building structure being needed.	Requirement [2.4] Requirement [2.6] Requirement [2.11]
12.2	Overview of Nuclear Site Health and Safety and Conventional Fire Safety		
12.3	Nuclear Site Health and Safety and Conventional Fire Safety Claims, Arguments, Evidence		
12.4	Nuclear Site Health and Safety Codes, Standards / Methodologies		
12.5	Nuclear Site Health and Safety Assessment		
12.6	Conventional Fire Safety Codes and Standards / Methodologies		
12.7	Conventional Fire Safety – Claim 2.3.5.2		

Chapter Number	Chapter Title	Chapter Content	ONR GDA Guidance to RPs [21] Appendix 3 Step 2 Requirements
12.8	Chapter Summary and Contribution to ALARP	Its primary focus is to afford fire safety to plant workers and fire intervention personnel. The strategy is underpinned by the proposed RGP, which when followed is postulated demonstrates ALARP per ONR guidance. The strategy has also identified differences between RGP and the proposed design, with design adaptation recommendations and potential next steps (post GDA) outlined within the context of future ALARP demonstrations.	
12.9	References		
12.10	List of Appendices		
13	Part B Chapter 13 Radioactive Waste Management [56]		
13.1	Introduction	This chapter is a description of the radioactive waste management aspects for the reactor. It covers the nuclear liabilities regulations and focuses on the wastes generated during all operational phases of the SMR-300. It includes the codes, standards and the methodology used in design of these SSC, what specific CAE is related to them and any improvements that have been made or are yet to be made in the interests of reducing risks to ALARP.	Requirement [2.4] Requirement [2.6] Requirement [2.11]
13.2	Description of Radioactive Waste Management SSCs		
13.3	Radioactive Waste Management Claims, Arguments, Evidence		
13.4	Radioactive Waste Management Codes and Standards / Methodologies		
13.5	Design of Radioactive Waste Management SSCs		
13.6	Radioactive Waste Management Lifecycle		
13.7	Chapter Summary and Contribution to ALARP		
13.8	References		
13.9	List of Appendices		
14	Part B Chapter 14 Safety and Design Basis Accident Analysis [36]		
14.1	Introduction	This chapter presents the fault studies approach undertaken and presents the Consolidated Fault List and Preliminary Fault Schedule. It identifies the relevant claims, arguments and currently available evidence that form the basis of the safety case for the fault studies topic to a maturity appropriate for a PSR. It also summarises the approach to design basis accident analysis in the UK context and the extent to how this has been applied for GDA	Requirement [2.4] Requirement [2.6] Requirement [2.7] Requirement [2.11]
14.2	Design Basis Accident Analysis Claims, Arguments and Evidence		
14.3	Design Basis Accident Analysis Approach		
14.4	Fault Identification and Classification		
14.5	Safety Functions and Safety Measures		
14.6	Accident Analysis and Modelling		

Chapter Number	Chapter Title	Chapter Content	ONR GDA Guidance to RPs [21] Appendix 3 Step 2 Requirements
14.7	Chapter Summary and Contribution to ALARP	Step 2. It outlines the methodologies to identify, screen and group Postulated Initiating Events (PIE) that have been recognised to align with UK licensing requirements as well as the methodologies for transient and accident analysis in accordance with best practice whilst appropriately utilising US DSA data are understood. Design basis provisions have been assessed by analysing several selected bounding faults that have informed safety categorisation of claimed safety measures, with consequent requirements for redundancy, diversity and segregation. The analyses have also informed performance requirements, so that the safety measures can meet the deterministic success criteria relevant to the plant state that needs to be achieved following a postulated fault. The analysis undertaken so far provides confidence that the selected design basis faults can be adequately protected with margin to the acceptance criteria.	
14.8	References		
14.9	List of Appendices		
15	Part B Chapter 15 BDBA, Severe Accident Analysis, and Emergency Preparedness [57]		
15.1	Introduction	This chapter presents the beyond design basis accident analysis and severe accident analysis approach that have been undertaken. It presents the relevant claims, arguments and evidence applicable to the beyond design basis analysis and severe accident analysis and the codes and standards that are applicable. It presents the methodology that will be applied to beyond design basis accident analysis and severe accident analysis and any resulting approach to emergency preparedness and response.	Requirement [2.4] Requirement [2.6] Requirement [2.11]
15.2	Overview of Beyond Design Basis, Severe Accidents and Emergency Preparedness		
15.3	Beyond Design Basis, Severe Accidents and Emergency Preparedness Claims, Arguments and Evidence		
15.4	Beyond Design Basis, Severe Accidents and Emergency Preparedness Codes and Standards / Methodologies		
15.5	Topic Basis and Supporting Deliverables		
15.6	Deterministic Analysis of Dec-A Events		
15.7	Demonstration of Plant Response to DEC-B Events		
15.8	Safety Means for Accident Control and Mitigation		

Chapter Number	Chapter Title	Chapter Content	ONR GDA Guidance to RPs [21] Appendix 3 Step 2 Requirements
15.9	Accident Management and Emergency Preparedness		
15.10	Chapter Summary and Contribution to ALARP		
15.11	References		
15.12	List of Appendices		
16	Part B Chapter 16 Probabilistic Safety Assessment [58]		
16.1	Introduction	This chapter presents the probabilistic safety analysis undertaken in support of GDA Step 2. It presents the relevant claims, arguments and evidence applicable to the probabilistic safety analysis and the codes and standards that are applicable. It discusses the differences in design between SMR-160 and SMR-300 together with insights gained from the completed SMR-160 Level 1 and 2 probabilistic safety analyses. This is supported by insights gained from further sensitivity studies undertaken on the SMR-160 PSA to assess key SMR-300 design differences and changes made to align with UK regulatory expectation to build confidence in the expected risk profile for the SMR-300 design.	Requirement [2.4] Requirement [2.11]
16.2	Overview of L1 & L2 Probabilistic Safety Assessment		
16.3	Probabilistic Safety Assessment Claims, Arguments and Evidence		
16.4	PSA Codes and Standards		
16.5	Differences between the SMR-160 and the SMR-300		
16.6	Modes of Operation and Sources of Radio Nuclide Release		
16.7	PSA Review against UK RGP		
16.8	PSA Results and Insights		
16.9	Chapter Summary and Contribution to ALARP		
16.10	References		
16.11	List of Appendices		
17	Part B Chapter 17 Human Factors [59]		
17.1	Introduction	This chapter summarises the Human Factors good practice applied to the design of the generic SMR-300. A key aspect of the licensing of UK Civil nuclear facilities is demonstrating relevant good practice relating to the discipline of Human Factors has been applied in a systematic manner. This helps to ensure SSC are optimised for human performance, thus minimising the risk of human failure. This includes ensuring the	Requirement [2.4] Requirement [2.6] Requirement [2.11]
17.2	Overview of Human Factors		
17.3	Human Factors Claims, Arguments and Evidence		
17.4	Delivery of Human Factors Input to SMR-300 Design		
17.5	Codes, Standards and Methodologies		

Chapter Number	Chapter Title	Chapter Content	ONR GDA Guidance to RPs [21] Appendix 3 Step 2 Requirements
17.6	Design Substantiation	significant risks linked to human activities are appropriately identified, analysed, and substantiated.	
17.7	Identification of Human Failures		
17.8	Human Reliability Assessment		
17.9	Operating Philosophy and Concept of Operations		
17.10	Chapter Summary and Contribution to ALARP		
17.11	References		
17.12	List of Appendices		
18	Part B Chapter 18 Structural Integrity [60]		
18.1	Introduction	This chapter provides a description of the SSC with structural integrity claims and how these will be addressed during the design, build and operations of the reactor. In addition, this chapter outlines the codes and standards used by the SMR-300 as well as the approach to the achievement of integrity, demonstration of integrity and monitoring.	Requirement [2.4] Requirement [2.6] Requirement [2.11]
18.2	SSCs Within the Scope of Structural Integrity		
18.3	Structural Integrity Claims, Arguments and Evidence		
18.4	Structural Integrity Codes and Standards		
18.5	Higher Reliability Demonstration		
18.6	Achievement of Integrity		
18.7	Demonstration of Integrity		
18.8	Monitoring		
18.9	Chapter Summary and Contribution to ALARP		
18.10	References		
18.11	List of Appendices		
19	Part B Chapter 19 Mechanical Engineering [61]		
19.1	Introduction	This chapter outlines the Mechanical Engineering design process and procedures used to develop the SMR-300, the mechanical SSCs relevant to nuclear safety, the Codes and Standards used to develop mechanical SSCs, and related	Requirement [2.4] Requirement [2.6] Requirement [2.11]
19.2	Mechanical Engineering Claims, Arguments and Evidence		
19.3	Mechanical Engineering Design		
19.4	Mechanical Engineering Codes and Standards		

Chapter Number	Chapter Title	Chapter Content	ONR GDA Guidance to RPs [21] Appendix 3 Step 2 Requirements
19.5	Quality Manufacturing and Installation	submissions to substantiate the Claims and Arguments of this Chapter.	
19.6	Chapter Summary and Contribution to ALARP		
19.7	References		
19.8	List of Appendices		
20	Part B Chapter 20 Civil Engineering [62]		
20.1	Introduction	This chapter presents the Claims, Arguments and Evidence for the design of Civil Engineering SSCs that underpin the design of the generic SMR-300. It also includes codes and standards, analysis and design methodologies, defence in depth, manufacturing and EIMT.	Requirement [2.4] Requirement [2.6] Requirement [2.11]
20.2	Description of Civil Engineering SSCs		
20.3	Civil Engineering Claims, Arguments, Evidence		
20.4	Codes and Standards		
20.5	Design of Civil Engineering SSCs		
20.6	Defence in Depth		
20.7	Quality Manufacturing and EIMT		
20.8	Chapter Summary and Contribution to ALARP		
20.9	References		
20.10	List of Appendices		
21	Part B Chapter 21 External Hazards [63]		
21.1	Introduction	The chapter presents the approach to External Hazards applied in the development of the DRP including the codes, standards and international regulatory guidance followed. The identification and screening methodology applied to identify the credible External Hazards which are relevant to the deployment of the generic SMR-300 in Great Britain is also presented. A preliminary evaluation of each of the identified External Hazards is provided consisting of characterisation of the hazard, the derivation of the GB GSE parameter, and a preliminary evaluation of the DRP. Additionally, the specific CAE and any improvements that have been	Requirement [2.4] Requirement [2.6] Requirement [2.11]
21.2	Overview of External Hazards		
21.3	External Hazards Claims, Arguments and Evidence		
21.4	Codes and Standards		
21.5	External Hazard Identification		
21.6	SSCs with External Hazard Safety Functions		
21.7	External Hazard Evaluation		
21.8	Chapter Summary and Contribution to ALARP		
21.9	References		

Chapter Number	Chapter Title	Chapter Content	ONR GDA Guidance to RPs [21] Appendix 3 Step 2 Requirements
21.10	List of Appendices	made or are yet to be made in the interests of reducing risks to ALARP are highlighted.	
22	Part B Chapter 22 Internal Hazards [64]		
22.1	Introduction	The chapter presents the approach to Internal Hazards applied in the development of the DRP including the codes, standards and international regulatory guidance followed. The identification and screening methodology applied to identify the credible Internal Hazards which are relevant to the generic SMR-300. This chapter also outlines the assessment methodologies to be followed for Internal Hazards in line with UK regulatory expectations and the methodology for the inclusion of Internal Hazards within the future Fault Schedule. Additionally, the specific CAE and any improvements that have been made or are yet to be made in the interests of reducing risks to ALARP are highlighted.	Requirement [2.4] Requirement [2.6] Requirement [2.11]
22.2	Overview of Internal Hazards		
22.3	Internal Hazards Claims, Arguments and Evidence		
22.4	Internal Hazards Codes and Standards		
22.5	Internal Hazards Identification		
22.6	Internal Hazards Characterisation and Evaluation		
22.7	SSCs with Internal Hazard Safety Functions		
22.8	Future Internal Hazard Assessments		
22.9	Chapter Summary and Contribution to ALARP		
22.10	References		
22.11	List of Appendices		
23	Chapter 23 Reactor Chemistry [65]		
23.1	Introduction	This chapter describes how SMR-300 chemistry regimes and systems reduce chemistry-related risks So Far As Is Reasonably Practicable (SFAIRP), during all normal operating modes and accident conditions for all phases of the lifecycle.	Requirement [2.4]
23.2	Reactor Chemistry Claims, Arguments and Evidence		
23.3	Codes, Standards and Methodology		
23.4	Chemistry Specifications		
23.5	Reactor Coolant Chemistry		
23.6	Nuclear Island Auxiliary and Safety System Chemistry		
23.7	Secondary Chemistry and Turbine Island Auxiliary Systems		
23.8	Accident Chemistry		
23.9	Chapter Summary and Contribution to ALARP		

Chapter Number	Chapter Title	Chapter Content	ONR GDA Guidance to RPs [21] Appendix 3 Step 2 Requirements
23.10	Conclusion		
23.11	References		
23.12	List of Appendices		
24	Part B Chapter 24 Fuel Transport and Storage [66]		
24.1	Introduction	This chapter is a description of the fuel transport and storage features of the reactor design. Additionally, the specific CAE and any improvements that have been made or are yet to be made in the interests of reducing risks to ALARP are highlighted.	Requirement [2.4]
24.2	Fuel Transport and Storage Description		
24.3	Fuel Transport and Storage Claims, Arguments and Evidence		
24.4	Fuel Transport and Storage Design and Safety Assessment (Claim 2.2.17)		
24.5	Spent Fuel Management Lifecycle (Claim 2.3.4)		
24.6	Chapter Summary and Contribution to ALARP and BAT		
24.7	References		
24.8	List of Appendices		
25	Part B Chapter 25 Construction and Commissioning Approach [67]		
25.1	Introduction	This chapter is a description of the construction and commissioning approach for the reactor. The stages of construction and commissioning are discussed, along with the overall programme for these phases.	Requirement [2.2] Requirement [2.4] Requirement [2.12] Requirement [2.13] Requirement [2.14] Requirement [2.18]
25.2	Overview of Construction and Commissioning		
25.3	Construction and Commissioning Claims, Arguments and Evidence		
25.4	Construction and Commissioning Codes and Standards / Methodologies		
25.5	Construction and Commissioning Programme and Arrangements		
25.6	Chapter Summary and Contribution to ALARP		
25.7	References		
25.8	List of Appendices		
26	SMR GDA PSR PART B Chapter 26 Decommissioning Approach [68]		

Chapter Number	Chapter Title	Chapter Content	ONR GDA Guidance to RPs [21] Appendix 3 Step 2 Requirements
26.1	Introduction	This chapter is a description of the decommissioning approach for the generic SMR-300. It is aimed at nuclear liabilities regulations and intends to focus on the decommissioning strategy, disposal routes and design for decommissioning.	
26.2	Overview of Decommissioning Approach		
26.3	Decommissioning Approach Claims, Arguments and Evidence		
26.4	Decommissioning Strategy		
26.5	Design for Decommissioning		
26.6	Disposal Routes and Storage		
26.7	Decommissioning Faults and Hazards		
26.8	Nuclear Liabilities Regulations Compliance		
26.9	Chapter Summary and Contribution to ALARP		
26.10	References		
26.11	List of Appendices		

Table 3: PER Chapter Structure and Applicability of EA/NRW GDA Guidance

No.	Chapter Title	Chapter Content	EA/NRW GDA Guidance to RPs [23] Step 2 Requirements
1	PER Chapter 1: Radioactive Waste Management Arrangements [37]		
1.1	Acronyms and Abbreviations	This chapter describes the radioactive waste management strategies and arrangements for solid, liquid and gaseous radioactive waste, and spent fuel generated over the lifecycle of the reactor, in line with appropriate RSR principles, GDA guidance and GDA scope.	PSR Part B Chapter 11 [54] outlines how this PER chapter aligns with the EA/NRW GDA Guidance document, this information is not repeated within this table.
1.2	Introduction		
1.3	Regulatory Context		
1.4	Radioactive Waste Management Principles and Strategy		
1.5	Radioactive Waste Management		
1.6	Sustainability Considerations		
1.7	Disposability Assessment		

No.	Chapter Title	Chapter Content	EA/NRW GDA Guidance to RPs [23] Step 2 Requirements
1.8	Summary		
1.9	References		
1.10	List of Appendices		
2	PER Chapter 2: Quantification of Effluent Discharges and Limits [38]		
2.1	Acronyms and Abbreviations	This chapter presents the methodologies and approaches for estimating liquid and gaseous effluent discharges from the generic SMR-300 design and determines potential limits during normal operation.	PSR Part B Chapter 11 [54] outlines how this PER chapter aligns with the EA/NRW GDA Guidance document, this information is not repeated within this table.
2.2	Introduction		
2.3	Regulatory Context		
2.4	Development of a Source Term for Estimating Radioactive Discharges		
2.5	Effluent Processing Routes		
2.6	Methodology for Estimating Effluent Discharges		
2.7	Methodology for Determining Limits to Effluent Discharges		
2.8	Prospective Discharge Limits		
2.9	Proposed Discharge Limits		
2.10	Comparison with Similar Plants		
2.11	Summary		
2.12	References		
2.13	List of Appendices		
3	PER Chapter 3: Radiological Impact Assessment [39]		
3.1	Definitions and Abbreviations	This chapter presents the assessment methods and input data for the assessment of the radiological impact on the environment and members of the public, of gaseous and liquid discharges from a twin generic SMR-300 facility at a generic UK site as required of RPs by the regulators within the GDA process.	PSR Part B Chapter 11 [54] outlines how this PER chapter aligns with the EA/NRW GDA Guidance document, this information is not repeated within this table.
3.2	Introduction		
3.3	Regulatory Context		
3.4	Methodology for Radiological Impact Assessment		
3.5	Preliminary Radiological Impact Assessment		
3.6	Summary		
3.7	References		

No.	Chapter Title	Chapter Content	EA/NRW GDA Guidance to RPs [23] Step 2 Requirements
4	PER Chapter 4: Conventional Impact Assessment [40]		
4.1	Acronyms and Abbreviations	This chapter presents information about conventional aspects of the design, including potential impacts on the environment of discharges from combustion plant, cooling and process water discharges, water abstraction, use of fluorinated gases, and use of dangerous substances subject to Control of Major Accident Hazards (COMAH) Regulations. This chapter also summarises sustainability aspects of the design.	PSR Part B Chapter 11 [54] outlines how this PER chapter aligns with the EA/NRW GDA Guidance document, this information is not repeated within this table.
4.2	Introduction		
4.3	Regulatory Context		
4.4	Water Use and Abstraction		
4.5	Discharge to Surface Water		
4.6	Discharge to Groundwater		
4.7	Operation of Installations (combustion plant and incinerators)		
4.8	Control of Major Accident Hazards Regulations		
4.9	Fluorinated Greenhouse Gases and Ozone-Depleting Substances		
4.10	Sustainability		
4.11	Claims, Arguments, and Evidence		
4.12	Summary		
4.13	References		
5	PER Chapter 5: Monitoring and Sampling [41]		
5.1	Acronyms and Abbreviations	This chapter aims to demonstrate that adequate monitoring and sampling arrangements of the SMR-300 are in place to inform the management of radioactive waste and recording and reporting of discharges, which contributes to minimising radioactive wastes and protection of the public and environment. It presents the arrangements for sampling and monitoring which aim to satisfy the information requirements in the Environment Agency's GDA guidance [23].	PSR Part B Chapter 11 [54] outlines how this PER chapter aligns with the EA/NRW GDA Guidance document, this information is not repeated within this table.
5.2	Introduction		
5.3	Regulatory Context		
5.4	System and Equipment Descriptions		
5.5	Gaseous Sampling and Monitoring		
5.6	Liquid Sampling and Monitoring		
5.7	Solid and Non-Liquid Sampling and Monitoring		
5.8	How Chapter Contributes to BAT		
5.9	Summary		
5.10	Glossary		
5.11	References		

No.	Chapter Title	Chapter Content	EA/NRW GDA Guidance to RPs [23] Step 2 Requirements
6	PER Chapter 6: Demonstration of Best Available Techniques [42]		
6.1	Acronyms and Abbreviations	This chapter summarises the demonstration of BAT for the Holtec Generic SMR-300 and follows the Claims, Arguments and Evidence (CAE) model which provides a transparent framework for the demonstration of BAT. This chapter outlines the main foci of BAT for the following: 1. Prevent the unnecessary creation of radioactive wastes and/or discharges. 2. Minimise the quantity and activity of any radioactive wastes and/or discharges created. 3. Minimise the impacts of radioactive wastes and/or discharges on people and the environment.	PSR Part B Chapter 11 [54] outlines how this PER chapter aligns with the EA/NRW GDA Guidance document, this information is not repeated within this table.
6.2	Introduction		
6.3	Overview of Generic SMR-300		
6.4	Regulatory Context		
6.5	BAT Methodology and Optimisation Process		
6.6	Demonstration of Claims		
6.7	Claim 3: Environmental Principles		
6.8	Claim 4: Environmental Protection		
6.9	Summary of Conclusions		
6.10	References		
6.11	List of Appendices		

Table 4: GSR Chapter Structure and Applicability of ONR GDA Guidance

No.	Report Title	Report Content	GDA Guidance to RPs [21]
1	Introduction	The GSR forms the head document of the security case. It presents the overall nuclear security case and how the evolving design is compliant with the UK nuclear security framework and meeting the security objectives. A public version of the GSR will also be produced which will be suitable for the generic SMR-300 GDA public consultation website.	Requirement [2.5] Requirement [2.9] Requirement [2.10] Requirement [2.11] Requirement [2.13] Requirement [2.20] Requirement [2.24]
2	Legislative and Regulatory Framework		
3	Security Philosophy and Principles		
4	Outline Nuclear Security Case		
5	Scope of GDA and Plant Information		
6	Threat Interpretation		
7	Identification of Assets / Areas for Protection		
8	Protection of Assets and Vital Areas		
9	Concept of Security Operations		
10	Evolution of GSR into NSSP		
11	References		

Table 5: PSgR and Basic Technical Characteristics Structure and Contents

No.	Report Title	Report Content
1	Introduction	Demonstrates Holtec's understanding of the safeguards requirement at the generic (international and UK domestic) level and RGP; presents an outline of the SMR-300 safeguards programme; presents an outline of the SMR-300 safeguards case and the main safeguards claims, showing how these claims integrate with the SMR-300 SSEC and progress on the development of the safeguards case; presents the basis for the accommodation of the safeguards requirement in the generic SMR-300 design, including information on the development of the safeguards design objective and safeguards design principles, and progress in the implementation of SgBD); presents progress on the development of conceptual safeguards arrangements, including the QNM flow and potential Material Balance Areas and Key Measurement Points; presents an outline of the evolution from GDA Step 2 to site licensing in the safeguards area, in accordance with the SMR-300 safeguards programme. A public version of the PSgR will also be produced which will be suitable for the generic SMR-300 GDA public consultation website.
2	Definitions and Abbreviations	
3	International and National Safeguards Framework	
4	Relevant Good Practice	
5	Overview of SMR-300 Safeguards Programme	
6	Nuclear Material Flow and Storage	
7	Overview of the SMR-300 Safeguards Case	
8	Safeguards by Design	
9	Nuclear Material Accountancy and Control	
10	UK Safeguards Expectations	
11	Evolution to Nuclear Site Licence	
12	References	

1.5 SUMMARY

This chapter introduces the Holtec generic SMR-300, the RP, the two-step GDA process and the corresponding SSEC documentation presented as part of the Step 2 GDA submission. It gives a high-level introduction, purpose, and scope for the Step 2 GDA SSEC; explains the UK regulatory regime and what the GDA process is, giving the main expectations on the RP and provides a structure through the SSEC where the requirements of each stakeholder are addressed.

The SSEC for the generic SMR-300 consists of the PSR, PER, GSR [3], PSgR [4] and supporting documents.

Holtec Britain has developed the SSEC with a future licensee's legal duties in mind, so that it is fit for use as the starting point for a site-specific SSEC.

The SSEC has been written to achieve its Fundamental Purpose: To demonstrate that the generic SMR-300 can be constructed, commissioned, operated, and decommissioned on a generic site in the UK to fulfil the future licensee's legal duties to be safe, secure and protect people and the environment.

The Fundamental Purpose is paramount and follows a golden thread throughout the SSEC. It can be achieved as a combination of the PSR Objective (subchapter 1.3.1) together with the PER Fundamental Objective (subchapter 1.3.2) the GSR Fundamental Objective (subchapter 1.3.3) and the PSgR Fundamental Objective (subchapter 1.3.4).

A statement on fundamental objectives being achieved are described within the PER, GSR and PSgR. PSR Part A Chapter 5 'Summary of ALARP and SSEC' [35] describes the fundamental objective being achieved within the PSR and the achievement of the fundamental purpose for the SSEC.

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