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1.1 INTRODUCTION

This chapter introduces the Holtec Small Modular Reactor (SMR)-300, and the corresponding Safety, Security and Environmental Case (SSEC) 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, 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.

1.1.1 Purpose

The introduction chapter consists of the following subchapters:

- **Introduction –** gives a high-level introduction, purpose, and scope for the Step 2 GDA SSEC.
- **Background** – gives the background to the SMR-300 development programme and other international licensing studies.
- **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.
- **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) [1] and Preliminary Safeguards Report (PSgR) [2] in more detail and what each chapter within the documents contain.
- **Summary** and **References** – presents a summary of the introduction and the references cited within the chapter.

The introductory chapter is common across the SSEC submissions.

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1.1.2 Fundamental Purpose of the SSEC

The SSEC for the generic SMR-300 consists of the PSR, the PER, the GSR [1] and the PSgR [2]) and supporting documents. The complete set of SSEC documentation submitted for the GDA is captured within the Master Document Submission List (MDSL) [3]. Subchapter 1.4 covers the PSR, PER, GSR [1] and PSgR [2] in more detail. Figure 1 shows a visual representation of how the PSR, PER, PSR, PSgR and additional supporting documents for the SSEC.

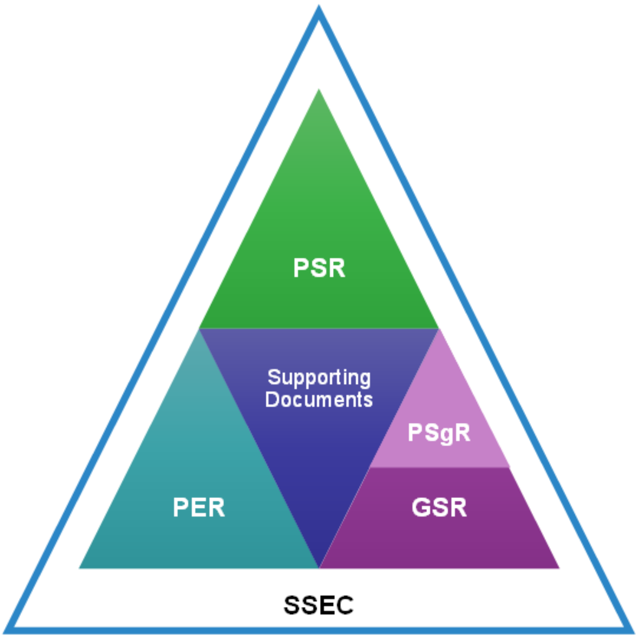

Figure 1: Safety, Security and Environmental Case

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 as follows.

- **SSEC Fundamental Purpose:** To demonstrate that the generic SMR-300 can be constructed, 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 heads a golden thread that flows throughout the SSEC. It can be achieved as a combination of the PSR Objective (subchapter 1.4.1) together with the PER Fundamental Objective (subchapter 1.4.2) the GSR Fundamental Objective (subchapter 1.4.3 below) and the PSgR Fundamental Objective (subchapter 1.4.4).

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

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

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- 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 will be a two-step GDA, which is described in more detail in subchapter 1.3.

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).
- Radioactive Waste Building (RWB).
- Intermediate Building (IB).
- Intermediate Spent Fuel Storage Installation (ISFSI).

PSR Part A Chapter 2 General Design Aspects and Site Characteristics [4] provides further detail on the GDA scope, including 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. It also explains the design principles, main codes and standards of design and the categorisation and classification methodology.

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1.2 INTRODUCTION TO THE GENERIC SMR-300

This subchapter presents a summary of the RP and the generic SMR-300. More detail on the evolution of the generic design, the reference design, and the generic site is provided in Chapter 2 'General Design Aspects and Site Characteristics' [4].

1.2.1 Requesting Party

The GDA will be managed by Holtec Britain Ltd., a wholly owned UK subsidiary of Holtec International with Company Number 07396592. Holtec Britain will provide the Regulatory Interface Office (RIO) and Project Management Office (PMO) including document controllers. All document transmittals from Holtec International to the UK regulators (and vice versa) will pass 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 GDA Input Reference Design are managed through 'Generic Design Assessment Reference Design Process and GDA Prospective Design Change Register' [5], further detail is provided within Chapter A4 of the PSR [6].

Holtec International has been a privately held company since its founding in 1986. A key subsidiary is SMR-LLC which is leading the licensing of SMR-300 in the United States (US) on behalf of Holtec International.

1.2.1.1 Requesting Party Objective

Holtec wish 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, operated, and decommissioned on a generic site in the UK, and fulfil the future licensee's 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 (initial assessment) of the UK GDA process with the objectives to:

- Fulfil the fundamental assessment purpose of the SSEC.
- Improve confidence amongst Stakeholders in the technology readiness for deployment and acceptability of the generic SMR-300.
- Reduce 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.

Holtec intends to undertake only Step 1 and Step 2 of the GDA. After completing Step 2 and gaining a Step 2 GDA Statement, Holtec will proceed to pursue statutory site licensing at the first site. The GDA process is described in more detail in subchapter 1.3.

1.2.2 Background to SMR-300

The generic SMR-300 is a two-loop, simplified, advanced light water reactor incorporating evolutionary and passive safety features. The design leverages 50-years of lessons learned and Pressurised Water Reactor (PWR) operating experience from proven technology to inform the plant design. The plant has been simplified relative to conventional large-scale reactors

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and incorporates both passive and robust systems to enhance its safety, construction, operation, and maintenance. Wherever possible, Holtec has anticipated the maintenance and life-extension challenges of current aging nuclear fleets and integrated applicable solutions traditionally back-fitted to existing plant designs into the plant design requirements. The generic SMR-300 eliminates the major modifications required to current plant designs to continue operation and manage spent fuel.

1.2.2.1 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. Protection is achieved by employing physical barriers and a defence-in-depth philosophy that is focused on mitigating the consequences of an accident should it occur. Central to this, the generic SMR-300 design does not require operator action or reliance on off-site or on-site Alternating Current (AC) power for accident mitigation.

The generic SMR-300 design is based on proven technology and aims to minimise technology development and licensing risks. The generic SMR-300 design draws on the operating experience and lessons learned from six decades of operating nuclear power plants, resulting in a simplified plant with respect to construction, operation, inspection, and maintenance as compared to second and third generation Light-Water Reactors (LWRs).

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 AC power for 72 hours.
- Defence-in-depth approach to beyond design basis accident mitigation.
- Reliable active systems to support normal plant operation.

The generic SMR-300 design replaces features and equipment in existing LWR plant designs with improved, simplified and passively safe systems[1]. 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 required to mitigate events deemed to be credible for consideration in the

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

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safety analysis. 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' [4].

PSR Part A Chapter 3 [7] summarises the Claims, Arguments and Evidence (CAE) made for the operation of the generic SMR-300.

Part A Chapter 4 of the PSR [6] describes the safety management and quality assurance applied by the RP during the GDA process and the requirements for its' continued management during the site licensing, operations, and decommissioning phases for the generic SMR-300. Part A Chapter 5 [8] discusses the application of the ALARP principle by the capable organisation. The themes here are common across both the PSR, PER, GSR and the PSgR. The PER discusses how the application of the Best Available Techniques (BAT) have been used in the development of the generic SMR-300. Relevant Good Practice (RGP) and Learning from Experience (LfE) have also been incorporated into the GSR [1] and PSgR [2].

1.2.2.2 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 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 will be produced for the SMR-300 in 2024, allowing a licensing strategy and programme to be developed for a commercial US application.

1.2.3 Design Reference Point

Note that, because Holtec International is currently undergoing routine technical engagement with the US NRC, the design may still be subject to changes because of this process. Revision 0 of the Preliminary Safety Analysis Report (PSAR) is due to be completed in October 2025 and submitted to the NRC with a construction permit application at the end of 2026.

A reference design is used as the basis for the GDA and the PSR, to ensure there is a consistent and coherent approach to the maturity of evidence against which the safety of the SMR-300 plant is justified. It is normal practice for the reference design to continue to develop between each safety report, as changes will inevitably occur during the evolution of the design. The through life strategy for the generic SMR-300 is outlined within Part A Chapter 4 of the PSR 'Lifecycle Management of Safety and Quality Assurance' [6].

Any future UK licensee of a SMR-300 will be expected to both demonstrate that the overall design of the plant reduces risks to ALARP and uses BAT, as well as ongoing compliance against License Condition (LC) 20 (LC20: Modifications to Plant Under Construction) [9].

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During the GDA process, prospective design changes to the GDA Input Reference Design are managed through HPP-3295-0017 - Holtec SMR-300 Generic Design Assessment Reference Design Process and GDA Prospective Design Change Register [5].

The Generic SMR-300 design development is captured in Chapter A4 of the PSR [6], which explains how the design has evolved because of these studies and will continue to evolve throughout its lifecycle.

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1.3 UK NUCLEAR REGULATORY REGIME AND GENERIC DESIGN ASSESSMENT

This chapter of the report provides guidance on regulatory oversight of 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 and EA is also provided.

1.3.1 UK Nuclear Regulatory Regime

In accordance with the Fundamental Purpose, the SSEC has been produced with the UK nuclear and environmental safety regulatory framework in mind. 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 Radioactive Substances Act 1993 [13].
- The Environment Act, 1995 (Web: Environment Act 2021 (legislation.gov.uk)) [14].
- The Environmental Permitting (England and Wales) Regulations 2016 (EPR16) [15].
- The Nuclear Industries Security Regulations (NISR) 2003 [16].
- The Nuclear Safeguards Regulations (EU Exit) 2019 [17].

The nuclear safety assessment (PSR) will be guided by the:

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

The environment case (PER) will be mainly guided by the:

- New nuclear power plants: Generic Design Assessment Guidance for Requesting Parties [22].
- EA Radioactive Substances Regulations (RSR): Objective and Principles [23].
- EA RSR Generic Developed Principles: Regulatory Assessment [24].

The security assessment (GSR) will be guided by the:

- ONR Security Assessment Principles (SyAPs) [25].
- ONR TAGs.
- ONR TIGs.
- Guidance on the Security Assessment of Generic New Nuclear Reactor Designs [26].

In addition to the TAGs and TIGs, the safeguards assessment (PSgR) will be guided by the:

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- ONR Nuclear Material Accountancy, Control, and Safeguards (ONMACS) Assessment Principles [27].

Codes, standards, and methodologies appropriate to the design of the Generic SMR-300 are summarised in Part A Chapter 2 of the PSR [4] and in each chapter within Part B of the PSR, and within the PER, GSR [1] and PSgR [2].

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

1.3.2 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 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.

An extensive but high-level comparison of UK and US regulation is presented in the US/UK Regulatory Framework and Principles Report [30], issued during GDA Step 1, which covers safety, security and environmental regulations in both regimes. This is further elaborated upon within each chapter of the respective SSEC document.

1.3.3 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 and environmental protection. For the RP, this offers a reduction in uncertainty and project risk regarding the design, safety, security, and environmental protection cases to enable future licensing, permitting, construction and regulatory activities.

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The GDA process for the generic SMR-300 will consist of two steps, as follows:

- 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 and security cases increases. Importantly, this Step includes the RP identifying any immediate gaps in meeting regulatory expectations and proposing how these will be subsequently resolved.
- Step 2 is the fundamental assessment of the generic safety and security cases, to identify any potential 'showstoppers' that may preclude deployment of the design.

The current ONR guidance to RPs ONR-GDA-GD-006 [22] and EA/NRW GDA guidance to RPs [31] has been produced for all future GDA activities. Section 2 Table 2 of ONR-GDA-GD-006 [22] suggests several different approaches to the GDA that the RP may wish to consider, dependent on the design maturity. Holtec believe that the generic SMR-300 is 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, safety, environmental, security and safeguards cases 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 implications and interfaces of the systems, structures, and components.

At the end of Step 2, 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. It will also identify matters which might conflict with UK government policy.

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.

1.3.4 GDA Compliance

The current ONR guidance to RPs ONR-GDA-GD-006 [22] and EA/NRW GDA guidance to RPs [31] has been produced for all future GDA activities. In addition to incorporating the latest lessons learned, 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

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environmental protection achieved previously and the robustness of the regulatory decision making.

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

From the ONR perspective, the Tables in Appendix 2 to 4 of ONR-GDA-GD-006 [22] are a key part of the guidance for the PSR. 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 will give the RP the greatest opportunity to provide quality documentation that meets these expectations in a timely manner.

The regulatory expectations and requirements for the environment case for the whole GDA process are elaborated in the GDA guidance 'New Nuclear Power Plants: Generic Design Assessment Guidance for Requesting Parties [31]', where the RP are expected to summarise the following eight items:

- 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 1.3.1.

EA/ NWP

- The Radioactive Substances Regulations (RSR) [24] and supporting principles: Radioactive Substances Management Developed Principles (RSMDP) [32], Radiological Protection Developed Principles (RPDP) [33], and Decommissioning Developed Principles (DEDP) [34], 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 [23] and RSR: Generic Developed Principles [24] documents which underpin the permit conditions within the RSR permits. Within GDA process, all relevant RSR principles will be considered and addressed appropriately in the development of environment case commensurate with GDA scope [35].

ONR

- ONR-GDA-GD-007 [36], the SAPs [25], TAG NS-TAST-GD-051 [37] on "The Purpose, Scope and Content of Nuclear Safety Cases" and the Site Licence Conditions [18] have been used in developing the Step 2 GDA SSEC.

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Basic compliance to these requirements has been highlighted in the SSEC Structure in subchapter 1.5. Further details regarding the relevant codes and standards is provided within each chapter of the respective SSEC document.

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1.4 SAFETY, SECURITY AND ENVIRONMENTAL CASE OVERVIEW

This subchapter provides an overview of the SSEC and the individual submissions: the PSR, the PER the GSR and the PSgR [1]. 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 1.4.1) together with the PER Fundamental Objective (subchapter 1.4.2), GSR Fundamental objective (subchapter 1.4.3 below) and the PSgR Fundamental Objective (subchapter 1.4.4). This is visualised in a simple hierarchy in Figure 2.

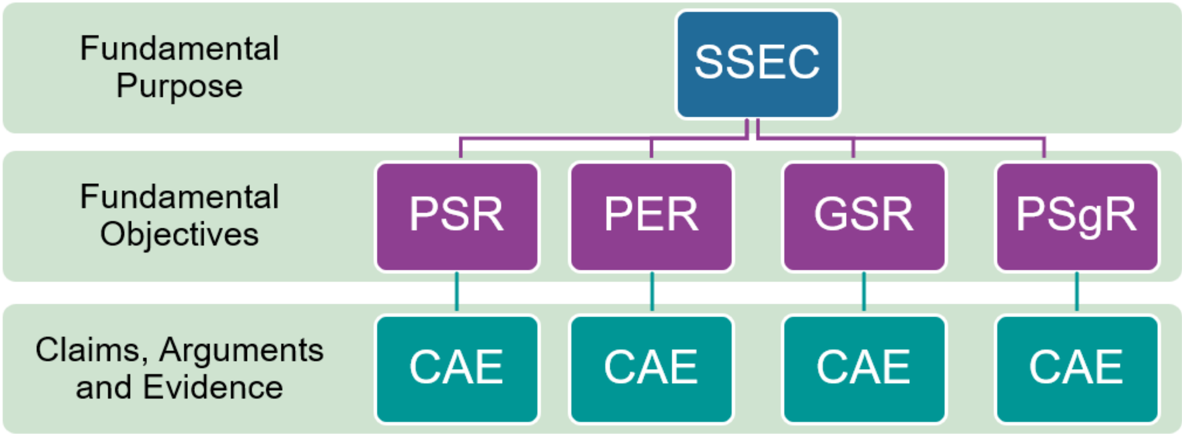

Figure 2: The Fundamental Purpose, Objective and CAE Hierarchy

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.

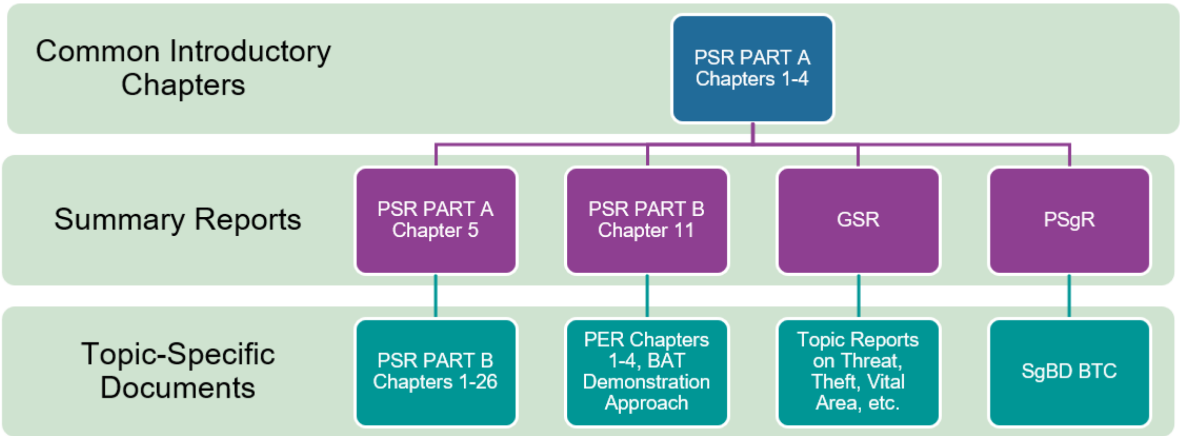

Figure 3: The SSEC Documentation Structure

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

1.4.1 Holtec GDA PSR

Holtec Britain is required to provide ONR with a safety case for the Nuclear Power Plant (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.

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

The Holtec GDA PSR relates to the nuclear safety 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 1.3. It has been split into two parts with distinct chapters.

- PART A is intended to be a summary of the safety case for the generic SMR. It is UK-focussed and standalone. Chapter 2 General Design Aspects and Site Characteristics of the PSR [4] 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 [6] explains the safety case management framework and demonstrates that the SSEC takes account of experience from the past (LfE), is written in the present, and sets expectations and guidance from RGP for the processes that should operate in the future if the hazards are to be controlled to reduce risks ALARP. This chapter also provides a summary of any significant GDA commitments identified across the PSR and the processes by which current gaps in the safety justification are being managed. Part A Chapter 5 'Summary of ALARP and SSEC' [8] provides and 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 and the processes by which current gaps in the safety justification are being managed.
- PART B is intended to focus 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[2] are a description of the design and main operating systems. Chapters B9-B13 describe normal operational aspects of the reactor. Part B Chapter 10 'Radiological Protection' [38] describes the environmental protection features claimed in the PSR, with reference to the PER. 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' [39] contains the preliminary fault schedule for the PSR. Chapters B17 – B26 are focussed on specific topic areas, such as structural integrity, giving more details that are relevant for the topic.

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.

[2] Chapter B3, B7 and B7 are unused within the current PSR at Revision 0.

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1.4.2 Holtec GDA PER

The PER works together with relevant part 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 design protects people and the environment from harm and applies Best Available Techniques, incorporates 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 [31] 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 at this stage consists of four separate chapters:

- PER Chapter 1: Radioactive Waste Management Arrangements [40].
- PER Chapter 2: Quantification of Effluent Discharges and Limits [41].
- PER Chapter 3: Radiological Impact Assessment [42].
- PER Chapter 4: Conventional Impact Assessment [43].

The common chapters across safety case, security and environmental case are:

- Part A Chapter 1 Introduction.
- Part A Chapter 2 General Design Aspects and Site Characteristics [4].
- Part A Chapter 3 Claims, Arguments and Evidence [7]
- Part A Chapter 4 Lifecycle Management of Safety and Quality Assurance [6]

A separate topic report has been produced that describes BAT demonstration approach for the generic SMR-300, responding to the specific information required for BAT demonstration in GDA guidance [31].

1.4.3 Holtec GDA GSR

The Holtec GDA GSR [1] 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 will be focused on the methodologies, approaches, codes, standards, and philosophies which together will form the building blocks for the development of the site security case and site security arrangements/security plan.

Step 2 will include an illustration of the implementation of the methodologies using an area within the plant and a system which will road-test the different aspects of the vital area identification and cyber security risk assessment methodologies respectively to build confidence that they are suitable and sufficient for use in subsequent project stages. This will

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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 [1] will form a head document at 'claims' level. Two versions of this head document will be presented in Step 2 to enable the GSR to be subject to public comments. The public version may require redaction of any commercially sensitive or security-related information.

The head document GSR will be supported by several claims-level 'Tier 2' documents which will provide Topic Reports supporting the GSR, including:

- Threat interpretation.
- Vital Area Identification and Categorisation (VAI&C).
- Cyber Security Risk Assessment (CSRA).
- Theft Categorisation.
- Secure by Design.
- Conceptual Security Arrangements.

1.4.4 Holtec GDA PSgR

The Holtec GDA PSgR [2] 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 will be to demonstrate to 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 will present:

- Progress on the implementation of SgBD.
- Progress in the development of the safeguards case.
- Progress on the development of conceptual safeguards arrangements, including QNM Flow and potential Material Balance Area / Key Measurement Points.
- The first issue of the generic SMR-300 SgBD Basic Technical Characteristics (BTC) (as a stand-alone appendix to the PSgR) to support engagement with ONR. This will be an informal issue noting that the first formal submission is not required until the decision to construct at a specific site is taken.
- The evolution from GDA Step 2 to site licensing in the safeguards area, in accordance with the generic SMR-300 safeguards programme.

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1.4.5 Lessons Learnt and Relevant Good Practice

Subchapter 1.3 presents GDA compliance requirements and the relevant learning for structure of the SSEC has been informed by previous GDAs, TAG 51 [37], GDA guidance [31] and other UK licensees examples of safety case and environmental case structure. PSR Part A is intended to be a standalone summary of UK-focussed topics and the safety arguments for the whole case, whereas PSR Part B identifies discipline-specific issues. The PER, GSR [1] and the PSgR [2] sit alongside this and focus on their discipline-specific issues, with Part A Chapters 1 and 2 supporting as a common introduction.

Based on previous UK licensees' practice, the PSR, PER, GSR and the PSgR dovetail into the Holtec generic SMR-300 SSEC to produce a robust safety and environmental case, minimising the repetition across the whole case.

1.4.6 Supporting Documentation

Documentation supporting the PSR, PER, GSR [1] and the PSgR [2] for the GDA submission includes various design documents, descriptions, and methodologies. This information is captured in the MDSL [3] to form the SSEC and the complete GDA submission.

1.4.6.1 MDSL Contents

The MDSL [3] 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 linked to the SSEC head reports (see Figure 1). Documents not submitted for assessment are excluded from the MDSL. Documents not connected, at any tier (see Figure 4), the SSEC head reports are excluded from the MDSL.

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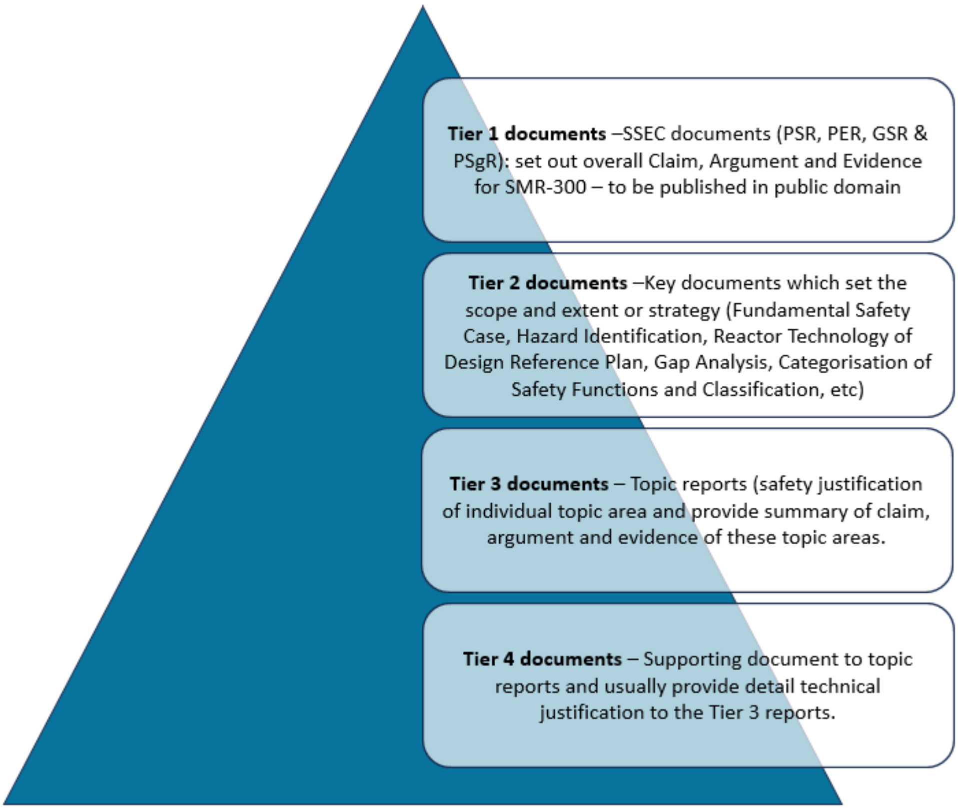

Figure 4: Tiered Document Structure for GDA

Regulatory Queries (RQs) and Regulatory Observations (ROs) and the responses provided by Holtec Britain will be considered in GDA, but their contents will be captured and integrated into the reports included in the MDSL [3]. The original RQ or RO responses will be excluded from the MDSL.

1.4.6.2 MDSL Structure

The structure of the MDSL [3] is divided into four discrete tiers:

- 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, hazards identification, design reference plant, gap analysis, categorisation of safety functions etc.).
- Tier 3: Topic reports that justify the safety in an individual topic area. These reports provide a summary of CAE.
- Tier 4: Supporting documents to topic reports providing detailed technical justifications.

The MDSL [3] will be updated at the end of the Step 2 GDA to capture the complete GDA submission documentation at the relevant revision.

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1.4.7 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 Chapter A4 ‘Lifecycle Management of Safety and Quality Assurance’ [6].

The overarching management arrangements for the GDA process and Holtec 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]. Chapter A4 ‘Lifecycle Management of Safety and Quality Assurance’ [6] 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 Forward Actions arising from the SSEC.

Some of the Security and Safeguards submissions have been issued within Step 1, the remainder of the SSEC Revision 0 is scheduled for delivery at the start of Step 2. The production of supporting Tier 2 and Tier 3 information continues during the 11-month Step 2 period, which culminates in the final GDA submission; the SSEC at Revision 1.

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1.5 SAFETY, SECURITY AND ENVIRONMENTAL CASE STRUCTURE

To achieve the Fundamental Purpose of the SSEC Holtec has considered the GDA guidance identified in subchapter 1.3.4. 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 Guidance to RPs' [22] to the PSR chapters has also been highlighted in Table 1 and Table 2 (c.f. subchapter 1.3.4). Each PSR chapter also contains an interfaces table, which relates the contents of the chapter to other associated chapters within the PSR.

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 'EA/NRW GDA Guidance to RPs' [31] to the PER chapters has also been highlighted in Table 3 (c.f. subchapter 1.3.4). However, a separate topic report has been produced that demonstrates BAT for the design, operation and decommissioning of the generic SMR-300, responding to the specific GDA guidance on BAT demonstration. This report structure is presented in Table 4.

The GSR structure is presented in Table 5. A brief description of the report contents is given in the table. Applicability of Step 2 requirements presented in 'GDA Guidance to RPs' [31] to the GSR has also been highlighted in Table 5 (c.f. subchapter 1.3.4). The PSgR structure is outlined in Table 6.

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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 [22] 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	Introduction to the Generic SMR-300		
1.3	UK Nuclear Regulatory Regime and Generic Design Assessment		
1.4	Safety, Security and Environmental Case Overview		
1.5	Safety, Security and Environmental Case Structure		
1.6	Summary		
1.7	References		
2	Part A Chapter 2 General Design Aspects and Site Characteristics [4]		
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. 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	Generic SMR-300 UK Codes, Standards and Metrication Road Map		
2.8	Generic Site Envelope		
2.9	Chapter Summary and Contribution to ALARP		
2.10	References		
2.11	List of Appendices		
3	Part A Chapter 3 Claims, Arguments and Evidence [7]		
3.1	Introduction		

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Chapter Number	Chapter Title	Chapter Content	ONR GDA Guidance to RPs [22] Appendix 3 Step 2 Requirement
3.2	Codes, Standards and Methodology	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]
3.3	CAE Trail		
3.4	Summary, Forward Actions and Commitments		
3.5	References		
3.6	List of Appendices		
4	Part A Chapter 4 Lifecycle Management of Safety and Quality Assurance [6]		
4.1	Introduction	This chapter describes the safety management and quality assurance applied by the RP during the GDA process and the requirements for its' continued management during the site licensing, operations, and decommissioning phases for the generic SMR-300. It discusses the application of the ALARP principle by the capable organisation. The themes here are common across both 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 MSQA Framework		
4.3	Claims, Arguments, Evidence Overview		
4.4	Codes, Standards and Methodologies		
4.5	Organisation		
4.6	SMR-300 GDA Project Delivery		
4.7	Specific Quality Assurance Arrangements		
4.8	Management of Design and SSEC		
4.9	Chapter Summary and Contribution to ALARP		
4.10	References		
5	Part A Chapter 5 Summary of ALARP and SSEC [8]		
5.1	Introduction	This chapter provides and 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 [2.17] Requirement [2.14] Requirement [2.12] Requirement [2.13]
5.2	The ALARP Principle		
5.3	ALARP Claims, Arguments and Evidence Overview		
5.4	Codes, Standards and Methodology		
5.5	Relevant Good Practice		
5.6	ALARP Design Process		
5.7	Tolerability of Risk		
5.8	Optioneering and Review		

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Chapter Number	Chapter Title	Chapter Content	ONR GDA Guidance to RPs [22] Appendix 3 Step 2 Requirement
5.9	Conclusion on the Fundamental Objective of the PSR		
5.10	Conclusion on the Fundamental Objectives of the PER, GSR and PSgR		
5.11	Overall SSEC Conclusion on the Fundamental Purpose		
5.12	References		

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 [22] Appendix 3 Step 2 Requirements
1	Part B Chapter 1 Reactor Coolant System and Engineered Safety Features [46]		
1.1	Introduction	This chapter is a description of the reactor coolant systems and the main engineered safety features. Part B focusses on the codes, standards and the methodology used in design of these Structures, Systems, and Components (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]
1.2	Overview of Plant System		
1.3	Claims, Arguments, Evidence		
1.4	Codes, Standards and Methodology		
1.5	Reactor Coolant System		
1.6	Engineered Safety Features		
1.7	Chapter Summary and Contribution to ALARP		
1.8	References		
1.9	Lis of Appendices		
2	Part B Chapter 2 Reactor [47]		
2.1	Introduction	This chapter is a description of the reactor fuel and core. Part B 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	Claims, Arguments, Evidence		

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Chapter Number	Chapter Title	Chapter Content	ONR GDA Guidance to RPs [22] Appendix 3 Step 2 Requirements
2.4	Codes, Standards and Methodology		
2.5	Reactor		
2.6	Thermal Mechanical Design		
2.7	Nuclear Design		
2.8	Thermal-Hydraulic Design		
2.9	Chapter Summary and Contribution to ALARP		
2.10	References		
2.11	List of Appendices		
3	Part B Chapter 3 Engineered Safety Features – Chapter Not Used - Reserved for Future Safety Cases. Information Incorporated into Chapter B1		
4	Part B Chapter 4 Control & Instrumentation (I&C) [48]		
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	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		
4.9	References		
4.10	List of Appendices		
4.11	References		
5	Part B Chapter 5 Reactor Supporting Facilities [49]		
5.1	Introduction	This chapter is a description of the auxiliary and steam & 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	Claims, Arguments, Evidence		
5.3	Codes, Standards and Methodology		
5.4	Auxiliary Systems		

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Chapter Number	Chapter Title	Chapter Content	ONR GDA Guidance to RPs [22] Appendix 3 Step 2 Requirements
5.5	Steam and Power Conversion Systems		
5.6	Mechanical Handling Systems		
5.7	Heating, Ventilation and Air Conditioning Systems		
5.8	Chapter Summary and Contribution to ALARP		
5.9	References		
5.10	List of Appendices		
6	Part B Chapter 6 Electrical Engineering [50]		
6.1	Introduction	This chapter is a description of the electric power and electrical 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. It also includes a subchapter on grid code compliance.	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	Codes, Standards and Methodology		
6.5	Defence in Depth		
6.6	Adaption to UK Grid		
6.7	Quality Manufacturing and Installation Process		
6.8	Examination, Inspection, Maintenance and Testing		
6.9	Chapter Summary and Contribution to ALARP		
6.10	References		
6.11	List of Appendices		
7	Part B Chapter 7 Auxiliary Systems – Chapter Not Used - Reserved for Future Safety Cases. Information Incorporated into Chapter B5.		
8	Chapter Not Used - Reserved for Future Safety Cases.		
9	Part B Chapter 9 Conduct of Operations [51]		
9.1	Introduction	This chapter is a description of the normal operating systems of the reactor, including the limits and conditions of operation, Examination, Inspection, Maintenance and Testing (EIMT) requirements and ageing effects. Also included is a definition of 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]
9.2	Normal Operating States		
9.3	SSCs Essential to Normal Operations		
9.4	Normal Operations Claims, Arguments, Evidence		

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Chapter Number	Chapter Title	Chapter Content	ONR GDA Guidance to RPs [22] Appendix 3 Step 2 Requirements
9.5	Codes, Standards and Regulations		
9.6	Operating Limits and Conditions		
9.7	Operating Procedures		
9.8	Main Control Room and Remote Shutdown Facility		
9.9	Examination, Inspection, Maintenance and Testing		
9.10	Chapter Summary and Contribution to ALARP		
9.11	References		
10	Part B Chapter 10 Radiological Protection [38]		
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 the hierarchy of controls. It gives the radiological source terms for normal operating and accident conditions, and the expected operational doses to members of the workforce and the public. Also included are 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 and dose to ALARP.	Requirement [2.4] Requirement [2.6] Requirement [2.11]
10.2	Description of Radiological Protection SSCs		
10.3	Claims Arguments and Evidence Overview		
10.4	Codes, Standards and Methodologies		
10.5	Radiological Protection Requirements		
10.6	Design for Radiological Protection		
10.7	Dose Assessments for Workers and members of the Public		
10.8	Chapter Summary and Contribution to ALARP		
10.9	References		
10.10	List of Appendices		
11	Part B Chapter 11 Environmental Protection [52]		
11.1	Introduction	This chapter summarises the environment case and describes how the environmental Fundamental Object will be met as the GDA progresses.	Requirement [2.6] Requirement [2.11]
11.2	Claims, Arguments and Evidence		
11.3	Environmental Legislation and Policy		
11.5	The Environmental Impacts of the SMR-300		
11.5	References		
11.6	Lis of Appendices		
12	Part B Chapter 12 Control of Non-Radiological Hazards [53]		

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Chapter Number	Chapter Title	Chapter Content	ONR GDA Guidance to RPs [22] Appendix 3 Step 2 Requirements
12.1	Introduction	This chapter is a description of the engineered features in place to protect from conventional hazards in line with CDM Regulations [54], including fire. This is aimed at the topic areas covered by specific Health & Safety Executive (HSE) legislation. Also included are 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]
12.2	Description 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	Codes, Standards and Methodology		
12.5	Conventional Fire Safety Assessment		
12.6	Nuclear Site Health and Safety		
12.7	Chapter Summary and Contribution to ALARP		
12.8	References		
12.9	List of Appendices		
13	Part B Chapter 13 Radioactive Waste Management [55]		
13.1	Introduction	This chapter is a description of the radioactive waste management aspects for the reactor. It is aimed at nuclear liabilities regulations and intends to focus on the wastes generated during all operational phases. It includes 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]
13.2	Description of Radioactive Waste Management SSCs		
13.3	Radioactive Waste Management Claims, Arguments and Evidence		
13.4	Codes, Standards, and Methodology		
13.5	Design of Radioactive Waste Management SSCs		
13.6	Radioactive Waste Management Strategy		
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 [39]		
14.1	Introduction	This chapter presents the fault analysis approach that will be undertaken. It presents the relevant claims, arguments and evidence applicable to the fault analysis and the codes and standards that are applicable. It also presents the US approach to deterministic safety analysis based on the licensing basis events that will form the basis of the Step 2 fault analysis together with the UK context which sets out the key	Requirement [2.4] Requirement [2.6] Requirement [2.7] Requirement [2.11]
14.2	Description of Design Basis Accident Analysis		
14.3	Design Basis Accident Analysis Claims, Arguments, Evidence		
14.4	Codes, Standards and Methodologies		

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Chapter Number	Chapter Title	Chapter Content	ONR GDA Guidance to RPs [22] Appendix 3 Step 2 Requirements
14.5	PIE Identification, Screening & Grouping	elements of the fault analysis approach for the design basis accident analysis and the extent to how this will be applied for Step 2.	
14.6	Application and Use of Transient and Accident Analysis Computer Codes		
14.7	Design Basis Accident Analysis		
14.8	Chapter Summary and Contribution to ALARP		
14.9	References		
15	Part B Chapter 15 BDBA, Severe Accident Analysis, and Emergency Preparedness [56]		
15.1	Introduction	This chapter presents the beyond design basis accident analysis and severe accident analysis approach that will be 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 BDBA, SAA and EP		
15.3	BDBA, SAA and EP Claims, Arguments and Evidence		
15.4	Codes and Standards		
15.5	Beyond Design Basis Accidents		
15.6	Severe Accident Analysis		
15.7	Engineered Safety Features		
15.8	Accident Management and Emergency Preparedness		
15.9	Chapter Summary and Contribution to ALARP		
15.10	References		
15.11	List of Appendices		
16	Part B Chapter 16 Probabilistic Safety Assessment [57]		
16.1	Introduction	This chapter presents the probabilistic safety analysis approach that will be undertaken. It presents the relevant claims, arguments and evidence applicable to the probabilistic safety analysis and the codes and standards that are applicable. It presents the methodology that will be applied to probabilistic safety analysis together with the insights from the completed SMR-160 Level 1 and 2 probabilistic safety analyses to demonstrate the intent for SMR-300.	Requirement [2.4] Requirement [2.11]
16.2	Probabilistic Safety Assessment Claims, Arguments and Evidence		
16.3	PSA Codes and Standards		
16.4	L1 PSA Scope and Methodology		
16.5	L2 PSA Scope and Methodology		
16.6	PSA Quality, Scope and Applicability		
16.7	PSA Results and Insights		

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Chapter Number	Chapter Title	Chapter Content	ONR GDA Guidance to RPs [22] Appendix 3 Step 2 Requirements
16.8	Utilisation of the L1 and L2 PSAs During the Design Process		
16.9	Chapter Summary and Contribution to ALARP		
16.10	References		
16.11	List of Appendices		
17	Part B Chapter 17 Human Factors [58]		
17.1	Introduction	This chapter summarises the HF good practice applied to the design of the generic SMR-300. A key aspect of the licensing of nuclear facilities is demonstrating relevant good practice relating to the discipline of HF has been applied in a systematic manner. This helps to ensure SSCs are optimised for human performance, thus minimising the risk of human failure. This includes ensuring the significant risks linked to human activities are appropriately identified, analysed, and substantiated.	Requirement [2.4] Requirement [2.6] Requirement [2.11]
17.2	Human Factors Overview		
17.3	Human Factors Claims, Arguments and Evidence		
17.4	Human Factors Integration		
17.5	Codes and Standards		
17.6	Design Substantiation		
17.7	Human Based Safety Claims		
17.8	Operational Philosophy and Concept of Operations		
17.9	Chapter Summary and Contribution to ALARP		
17.10	References		
17.11	List of Appendices		
18	Part B Chapter 18 Structural Integrity [59]		
18.1	Introduction	This chapter is a description of the SSCS with structural integrity claims and how these will be addressed during the design, build and operations of the reactor. Codes and standards, equipment classification and qualification, as well as manufacturing are discussed.	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	Codes and Standards		
18.5	Methodology for Identifying Higher Reliability Components		
18.6	Higher Reliability Demonstration		
18.7	Achievement of Integrity		
18.8	Demonstration of Integrity		

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Chapter Number	Chapter Title	Chapter Content	ONR GDA Guidance to RPs [22] Appendix 3 Step 2 Requirements
18.9	Monitoring		
18.10	Chapter Summary and Contribution to ALARP		
18.11	References		
18.12	List of Appendices		
19	Part B Chapter 19 Mechanical Engineering [60]		
19.1	Introduction	This chapter is a description of the SSCs with mechanical engineering claims and how these will be addressed during the design, build and operations of the reactor. Codes and standards, equipment classification and qualification, as well as manufacturing are discussed.	Requirement [2.4] Requirement [2.6] Requirement [2.11]
19.2	Claims and Arguments		
19.3	Mechanical Engineering Design		
19.4	Codes, Standards and Methodology		
19.5	Quality Manufacturing and Installation		
19.6	Chapter Summary and Contribution to ALARP		
19.7	References		
19.8	List of Appendices		
20	Part B Chapter 20 Civil Engineering [61]		
20.1	Introduction	This chapter is a description of the SSCs with civil engineering claims and how these will be managed during the design, build and operations of the reactor. Codes and standards, equipment classification and qualification, as well as construction are discussed.	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, Standards and Methodology		
20.5	Design of Civil SSCs		
20.6	Defence in Depth		
20.7	Quality Manufacturing and Installation		
20.8	Chapter Summary and Contribution to ALARP		
20.9	References		
20.10	List of Appendices		
21	Part B Chapter 21 External Hazards [62]		
21.1	Introduction		

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Chapter Number	Chapter Title	Chapter Content	ONR GDA Guidance to RPs [22] Appendix 3 Step 2 Requirements
21.2	External Hazards Approach	The chapter presents the approach to External Hazards applied in the development of the GDA Reference Design 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 GDA Reference 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] Requirement [2.6] Requirement [2.11]
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		
21.10	List of Appendices		
22	Part B Chapter 22 Internal Hazards [63]		
22.1	Introduction	This chapter is a description of the identified internal hazards and outline of the design philosophies to be followed for Internal Hazards. SSCs and SFRs for the main engineered features are provided. 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 Evaluation		
22.7	SSCs with Internal Hazard Safety Functions		
22.8	Chapter Summary and Contribution to ALARP		
22.9	References		
22.10	List of Appendices		
23	Chapter 23 Reactor Chemistry [64]		
23.1	Introduction	This chapter is a description of the reactor chemistry features, focussing on how chemistry has been designed to give flexible and safe operations and maintenance activities. 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]
23.2	Reactor Chemistry Claims, Arguments and Evidence		
23.3	Codes, Standards and Methodology		
23.4	Chemistry Specifications		

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Chapter Number	Chapter Title	Chapter Content	ONR GDA Guidance to RPs [22] Appendix 3 Step 2 Requirements
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		
23.10	Conclusion		
23.11	References		
23.12	List of Appendices		
24	Part B Chapter 24 Fuel Transport and Storage [65]		
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 SSCs		
24.3	Fuel Transport and Storage Claims, Arguments and Evidence		
24.4	Codes and Standards		
24.5	Design of SSCs		
24.6	Safety Assessment		
24.7	Quality, Manufacturing, Installation and EIMT		
24.8	Spent Fuel Management Strategy		
24.9	Chapter Summary and Contribution to ALARP		
24.10	References		
24.11	List of Appendices		
25	Part B Chapter 25 Construction and Commissioning Approach [66]		
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	Construction and Commissioning Claims, Arguments and Evidence		
25.3	Codes, Standards and Methodology		
25.4	Construction and Commissioning Programme and Arrangements		

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Chapter Number	Chapter Title	Chapter Content	ONR GDA Guidance to RPs [22] Appendix 3 Step 2 Requirements
25.5	Chapter Summary and Contribution to ALARP		
25.6	References		
26	SMR GDA PSR PART B Chapter 26 Decommissioning Approach [67]		
26.1	Introduction	This chapter is a description of the decommissioning approach for the reactor. It is aimed at nuclear liabilities regulations and intends to focus on the wastes generated during all operational phases, and the aspects of design for decommissioning that have been considered.	
26.2	Decommissioning Approach Clams, Arguments and Evidence		
26.3	Codes, Standards and Methodology		
26.4	Decommissioning Strategy		
26.5	Design for Decommissioning		
26.6	Disposal Routes and Storage		
26.7	Decommissioning Faults and Hazards		
26.8	Chapter Summary and Contribution to ALARP		
26.9	References		
26.10	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 [31] Step 2 Requirements
1	PER Chapter 1: Radioactive Waste Management Arrangements [40]		
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.	• Information on the source of radioactive waste arisings. • The quantities and types of radioactive waste and spent fuel that are likely to arise during normal operation and in decommissioning (solid and spent fuel). • A description of gaseous, liquid, and solid waste management systems and their proposed operations. • OPEX and RGP for radioactive waste management, decommissioning and Spent Fuel Interim Storage (SFIS). • A credible plan to obtain a view from Nuclear Waste Services (NWS) on the disposability of any solid radioactive waste
1.2	Introduction		
1.3	Regulatory Context		
1.4	Radioactive Waste Management Principles and Strategy		
1.5	Radioactive Waste Management		
1.6	Summary		
1.7	References		

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No.	Chapter Title	Chapter Content	EA/NRW GDA Guidance to RPs [31] Step 2 Requirements
1.8	List of Appendices		arisings, including more challenging wastes and non-radiological hazardous substances arising across the reactor lifecycle. • The assessment of radioactive waste should address the waste form and any non-radioactive components that could have a bearing on its management and disposability. • During its engagement with NWS, the RP should identify any challenges the waste stream may present to the waste acceptance criteria for disposal facilities. • A credible plan to obtain a view from NWS on disposability of any solid radioactive waste arisings, including more challenging LLW arisings if any. • The RP's considerations at the design stage for meeting the joint regulators guidance on the decommissioning of nuclear sites and release from regulation.
2	PER Chapter 2: Quantification of Effluent Discharges and Limits [41]		
2.1	Acronyms and Abbreviations	This chapter presents the methodologies and approaches for assessing and reporting potential liquid and gaseous effluent discharges from the generic SMR-300 design and expected quantities and types of liquid and gaseous radioactive waste during normal operation.	Quantitative estimates of waste arisings for normal operation of discharges of gaseous and aqueous radioactive wastes. The quantities and types of radioactive waste during normal operation (gaseous and liquid)
2.2	Introduction		
2.3	Regulatory Context		
2.4	Development of a Source Term for Estimating Radioactive Discharges		
2.5	Discharges Routes		
2.6	Methodology for Estimating Effluent Discharges and Limits		
2.7	Prospective Effluent Discharges		
2.8	Proposed Discharge Limits		
2.9	Comparison with Similar Plants		
2.10	Summary		
2.11	References		
3	PER Chapter 3: Radiological Impact Assessment [42]		
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.	The impact on people and the environment of any proposed discharges of gaseous and liquid radioactive wastes
3.2	Introduction		
3.3	Regulatory Context		
3.4	Methodology for Radiological Impact Assessment		

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No.	Chapter Title	Chapter Content	EA/NRW GDA Guidance to RPs [31] Step 2 Requirements
3.5	Preliminary Radiological Impact Assessment		
3.6	Summary		
3.7	References		
4	PER Chapter 4: Conventional Impact Assessment [43]		
4.1	Acronyms and Abbreviations	This chapter presents information about conventional aspects of the design, including potential impacts on the environment of discharges from back-up diesel generators, cooling and process water discharges, other waste disposals.	Information about conventional aspects of the design, including potential impacts on people and the environment of discharges from back-up diesel generators, cooling and process water discharges, other waste disposals, and information about their approach to applying BAT (where applicable).
4.2	Introduction		
4.3	Regulatory Context		
4.4	Water Use and Requirements		
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	Summary		
4.12	References		

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Table 4: Approach and Application of the Demonstration of BAT [68]

No.	Chapter Title	Chapter Content	EA/NRW GDA Guidance to RPs [31] Step 2 Requirements
1	Definitions and Abbreviations	This report presents UK context related to BAT demonstration, BAT demonstration approach, decision-making process, and proposed BAT case structure.	The RP's approach and methodology for determining BAT to prevent or minimise radioactive wastes and their impact during the lifecycle of the plant – design, construction, commissioning, operation, and decommissioning. Worked example demonstrating the BAT approach and methodology sufficient to provide confidence that any fundamental concerns should be identified in Step 2.
2	Introduction		
3	Application of BAT		
4	Legislation, Regulations and Guidance		
5	Overview of the SMR-300 Design Decision Process		
6	Scope of BAT		
7	Approach to BAT		
8	Claims, Arguments and Evidence		
9	Summary		
10	References		

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Table 5: GSR Chapter Structure and Applicability of ONR GDA Guidance

No.	Report Title	Report Content	GDA Guidance to RPs [31]
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		

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Table 6: PSgR and Basic Technical Characteristics Structure and Contents

No.	Report Title	Report Content
1	Introduction	Demonstrates Holtec's understanding of safeguards requirements at the generic (international and UK) level, that 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. A public version of the PSgR will also be produced which will be suitable for the generic SMR-300 GDA public consultation website.
2	International and National Safeguards Framework	
3	Relevant Good Practice	
4	Overview of SMR-300 Safeguards Programme	
5	Nuclear Material Flow and Storage	
6	Overview of the SMR-300 Safeguards Case	
7	Safeguards by Design	
8	Nuclear Material Accountancy and Control	
9	Evolution to Nuclear Site Licence	
10	References	
Appendix to PSgR	SgBD Basic Technical Characteristics	Presents design information relevant to safeguards as required by the Nuclear Safeguards (EU Exit) Regulations 2019.

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1.6 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, the PER, the GSR [1] and the PSgR [2]) 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, 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 1.4.1) together with the PER Fundamental Objective (subchapter 1.4.2) the GSR Fundamental Objective (subchapter 1.4.3 below) and the PSgR Fundamental Objective (subchapter 1.4.4).

Achieving the Fundamental Purpose will give all stakeholders confidence in the generic SMR-300 and in Holtec Britain as the RP.

A statement on fundamental objectives being achieved are described within the PER, GSR and PSgR. Chapter A5 'Summary of ALARP and SSEC' [8] describes the fundamental objective being achieved within the PSR and the achievement of the fundamental purpose for the SSEC.

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