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19.1 INTRODUCTION

The Fundamental Purpose of the Generic Design Assessment (GDA) Safety, Security and Environment Case (SSEC) is to demonstrate that the generic Small Modular Reactor (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, as defined in Part A Chapter 1 [1].

The Fundamental Purpose is achieved through the Fundamental Objective of the Preliminary Safety Report (PSR), which is to summarise the safety standards and criteria, safety management and organisation, Claims, Arguments and Evidence (CAE) to demonstrate that the generic SMR-300 design risks to people are likely to be tolerable and As Low as Reasonably Practicable (ALARP) [1].

Part B Chapter 19 of the PSR presents the CAE for the Mechanical Engineering topic.

19.1.1 Purpose and Scope

The Overarching SSEC Claims are presented in Part A Chapter 3.

This chapter (Part B Chapter 19) links to the overarching claim through Claim 2.2:

Claim 2.2: The design of the systems and associated processes have been developed taking cognisance of relevant good practice and substantiated to achieve their safety and non-safety functional requirements.

As set out in PSR Part A Chapter 3 [2], Claim 2.2 is further decomposed across several engineering disciplines which are responsible for development of the design of relevant Systems, Structures and Components (SSCs).

This chapter presents the Mechanical Engineering topic for the generic SMR-300 to support Claim 2.2.10.

Claim 2.2.10: The overall design and architecture of mechanical SSCs ensures that safety functions and non-safety functions are delivered and faults arising from failures of the SSCs are minimised.

Claim 2.2.10 has been further decomposed within PSR Part B Chapter 19 Mechanical Engineering, across the design lifecycle, to provide confidence that the relevant requirements on mechanical SSCs will be met during all lifecycle phases. This has been done by breaking down Claim 2.2.10 into four further sub-claims.

The scope of this chapter includes the Mechanical Engineering design process and procedures used to develop the SMR-300, the mechanical SSCs relevant to nuclear safety, the Codes and Standards (C&S) used to develop mechanical SSCs, and related submissions to substantiate the claims and arguments of this chapter.

Sub-chapter 19.3 presents the design processes used across the Mechanical Engineering topic and the associated claim that identifies how the design processes support the overall safety of the SMR-300 design.

Sub-chapter 19.4 presents the C&S associated with Mechanical Engineering, establishes the purpose of the Mechanical Engineering Codes and Standards Report, and discusses how UK Relevant Good Practice (RGP) is incorporated into the SMR-300 design.

Sub-chapter 19.5 demonstrates the role that quality manufacturing, installation and maintenance practices that Holtec have established for the SMR-300 contribute to the delivery of a safe power plant design, and the associated claim and arguments to present this information.

Finally, sub-chapter 19.6 provides a technical summary of how the claims for this chapter have been achieved, together with a summary of key contributions from this chapter to the overall ALARP chapter. Sub-chapter 19.6.2.5 also discusses Commitments and planned activities from the Mechanical Engineering topic area.

The scope of PSR Part B Chapter 19 excludes the Security Facilities HVAC System (SFV).

To meet this purpose, the Mechanical Engineering chapter has many SSCs in scope. There are two main categories of SSCs:

- Sub-systems and components for plant-level systems delivering Safety Functional Requirements (SFRs) to ensure plant safety:
  - These SSCs are identified in various PSR chapters, including Part B chapters 1 [3], 2 [4], 5 [5], 10 [6], and 13 [7]. The plant-level systems identified in these chapters include mechanical SSCs that deliver and support SFRs.
  - Where plant-level SSCs include a mixture of mechanical and other SSCs, only the mechanical SSCs will be explored in this chapter.
- Mechanical SSCs whose failure could challenge the safety of the plant:
  - The scope of these SSCs is expected to develop as the Preliminary Fault Schedule [8] and the UK Design Basis Accident Analysis (DBAA) are developed through the safety analysis topic areas, led by Design Basis Analysis (Fault Studies), PSR Part B Chapter 14 [9].
  - SSC classification and safety function categorisation is an ongoing activity which is not complete at PSR Rev 1 and will continue through to PCSR and as the design develops. SSC classes and safety function categories will be identified through UK DBAA (as demonstrated in Commitment C_Faul_103 identified in PSR Part B Chapter 14 [9]) and future fault schedule development.

The SSCs in scope for this PSR chapter are discussed in the Mechanical Engineering Design Basis Report [10].

A master list of definitions and abbreviations relevant to all PSR Chapters can be found in Part A Chapter 2 [11].

19.1.2 Assumptions

There are no assumptions related to the Mechanical Engineering Topic. Assumptions registered across the project have been formally captured in the Commitments, Assumptions and Requirements process [12]. Further details of this process are provided in Part A Chapter 4.

19.1.3 Interfaces with Other SSEC Chapters

As Mechanical Engineering is a broad topic that is applied across the plant, there are many important interfaces. The primary interfaces are driven by the safety claims and associated SFRs.

19.1.3.1 Mechanical SSCs

Mechanical SSCs contribute to operational and safety functions. Functions are provided by plant-level systems identified in other chapters of the Holtec SMR-300 GDA PSR. These chapters are presented below.

Part A Chapter 4 Lifecycle Management of Safety and Quality Assurance [13] presents a high level description of life cycle management processes arrangements for the SMR-300 as-well-as the Quality Assurance arrangements.

Part B Chapter 1 Description of the Reactor Coolant System (RCS) and Engineered Safety Features (ESF) [3] identifies the systems delivering the primary circuit and engineered safety features of the SMR-300, including the Pressurizer, Automatic Depressurization System, and others. These systems include mechanical SSCs which are presented in this PSR Chapter and supporting documents.

Part B Chapter 2 Reactor Fuel and Core [4] identifies the systems delivering the safety features of the design of the fuel and core systems, including the Fuel System, Control Rod Drive Systems, and others. These systems include mechanical SSCs which are presented in this PSR Chapter and supporting documents.

Part B Chapter 5 Description of the Reactor Supporting Facilities [5] identifies the systems supporting the reactor and their operational and safety functions, including the Overhead Heavy Load Handling System, the Residual Heat Removal System, the Chemical and Volume Control System, and others. These systems include mechanical SSCs which are presented in this PSR Chapter and supporting documents.

Part B Chapter 10 Radiological Protection [6] identifies the approaches to radiological protection in the SMR-300 facility, including radiation zoning, systems providing radiation protection, systems that contribute to the boundaries of radiation zones, and other aspects of radiation protection. This relies on mechanical SSCs which are presented in this PSR Chapter and supporting documents.

Part B Chapter 12 Nuclear Site Health and Safety and Conventional Fire Safety [14] identifies conventional safety risks related to lifecycle, ensures that these risks are reduced SFAIRP, in line with the Construction (Design and Management) Regulations 2015 (CDM 2015), and presents fire safety aspects which mechanical SSCs support. There are specific interfaces with Conventional Fire Safety where mechanical SSCs are responsible for mitigating fire risks and managing fire hazards, such as ventilation SSCs for battery rooms and fire escape areas.

Part B Chapter 13 Radioactive Waste Management [7] identifies the approaches used for managing, measuring, and handling different types of radioactive waste in the SMR-300. This relies on mechanical SSCs which are presented in this PSR Chapter and supporting documents.

Part B Chapter 20 Civil Engineering [15] includes a description of the Containment Structure and related structures. These SSCs are included as part of the Passive Containment Heat Removal System (PCH) and interface with mechanical SSCs.

Part B Chapter 24 Fuel Transport and Storage [16] is a cross-cutting chapter that describes the fuel handling routes across the SMR-300 and the systems which are involved in this. This relies on mechanical SSCs which are presented in this PSR Chapter and supporting documents.

19.1.3.2 Mechanical Engineering Input

Mechanical engineering processes and procedures have been used to develop the safety case of the SMR-300. The broader interfaces extend to engineering procedures and the development of procedures, cross-cutting information and systems, as discussed below.

Mechanical SSCs are part of systems that respond to and mitigate Internal and External Hazards, discussed in chapters Part B Chapter 21 [17] and Part B Chapter 22 [18] respectively.

Plant-level systems rely on interdisciplinary work with input from different engineering teams, and are composed of SSCs that are described in several PSR chapters outlining the engineering practices and procedures, including Part B Chapter 4 Instrumentation and Control (I&C) [19], Part B Chapter 6 Electrical Engineering [20], Part B Chapter 18 Structural Integrity [21], and Part B Chapter 20 Civil Engineering [15].

Accident analysis, as outlined in Part B Chapter 14 Design Basis Accident Analysis [9], Part B Chapter 15 Beyond Design Basis Analysis, Severe Accidents Analysis and Emergency Preparedness [22], and Part B Chapter 16 Probabilistic Safety Analysis [23] considers the failure and response of plant systems, including their mechanical SSCs.

Plant operations are integral to the design of mechanical SSCs. The design of mechanical SSCs must incorporate aspects of many operations through the lifecycle of the SMR-300. Part B Chapter 9 Conduct of Operations [24] outlines the operations of the plant, which includes many mechanical SSCs in support of operations, as well as Examination, Inspection, Maintenance and Testing (EIMT) that ensure the continued performance of mechanical SSCs.

Environmental protection as outlined in Part B Chapter 11 Environmental Protection [25] is provided by specialised systems, with reliance on mechanical systems and components. Mechanical SSCs used in environmental protection include ventilation systems, seals, doors, and others.

19.2 MECHANICAL ENGINEERING CLAIMS, ARGUMENTS AND EVIDENCE

This chapter presents the Mechanical Engineering aspects for the generic SMR-300 and therefore directly supports Claim 2.2.10.

Claim 2.2.10: The overall design and architecture of mechanical SSCs ensures that safety functions and non-safety functions are delivered and faults arising from failures of the SSCs are minimised.

Major plant systems and safety systems rely on mechanical equipment to deliver safety functions, and mechanical SSCs must be designed with sufficient functional performance in support of those safety and non-safety functions. These functional performance requirements, as well as other safety requirements are ensured by the design, procurement and manufacturing steps. For this reason, mechanical SSCs support the safety and non-safety functions of equipment across the SMR-300, and this is ensured by the processes established to deliver these SSCs. This is outlined in Claim 2.2.10.1.

The selection of C&S used across the SMR-300 are established in Holtec design standards and procedures. These reflect the regulations from the United States Nuclear Regulatory Commission (US NRC), and guidance from the US NRC and Electric Power Research Institute (EPRI), all of which have been produced taking cognisance of Operating Experience (OPEX) from across the US nuclear power fleet. The C&S used have been assessed to determine whether they present a risk to meeting UK RGP and found that most C&S used across the SMR-300 have precedent in the UK nuclear sector, and the remainder are deemed low risk against RGP [26]. This is outlined in Claim 2.2.10.2.

While mechanical SSCs are designed to support the safety of the SMR-300, safety of a licensed site will rely on manufacturing, installation, commissioning and maintenance. Holtec have established controls to ensure that mechanical SSCs maintain high quality standards throughout the lifetime of an SMR-300 plant. This is summarised in Claim 2.2.10.3.

The overall Defence in Depth of the plant relies on equipment delivering safety functions being designed with several lines of protection. Safety-related mechanical SSCs must be appropriately designed to incorporate redundant features and to provide Defence in Depth. These design features are incorporated to support the overall Defence in Depth of the plant against relevant faults. This is summarised in Claim 2.2.10.4.

Claim 2.2.10 has been decomposed into four level 4 claims, which are shown in Table 1 and identifies in which section of this PSR chapter that these claims are demonstrated and their maturity with respect to a PSR for a 2-step GDA.

Table 1: Level 4 Claims Covered by Part B Chapter 19

Claim No.	Claim	Chapter Section
2.2.10.1	Design processes and procedures have been established to ensure mechanical specific safety requirements, functional requirements and architecture requirements are captured in the design, procurement and manufacturing steps.	19.3 Mechanical Engineering Design
2.2.10.2	Mechanical SSCs are designed using appropriate Codes and Standards, taking cognisance of Relevant Good Practice (RGP) and Operating Experience (OPEX).	19.4 Mechanical Engineering Codes and Standards
2.2.10.3	Mechanical SSCs achieve the design intent through quality manufacturing, installation and Examination, Inspection, Maintenance and Testing (EIMT) processes.	19.5 Quality Manufacturing and Installation
2.2.10.4	Mechanical SSC design incorporates Defence in Depth to protect against anticipated operational occurrences and accident conditions	19.3.3 Defence in Depth

Appendix A provides a full CAE mapping for Part B Chapter 19, which includes any lower-level CAE needed to support the claims in the table above. This includes identification of evidence available at PSR v1 and aspects for future development of evidence to support these claims beyond PSR v1.

19.3 MECHANICAL ENGINEERING DESIGN

Claim 2.2.10.1: Processes have been established to ensure mechanical specific safety requirements, functional requirements and architecture requirements are captured in the design, procurement and manufacturing steps.

This claim relates to the design processes used to develop mechanical SSCs and assure that the design process delivers SSCs designed to appropriate design requirements. This claim is supported by two arguments, A1 relating to incorporation of relevant design practices to mechanical SSCs (sub-chapter 19.3.1) and A2 that mechanical design processes have been reviewed against UK RGP (sub-chapter 19.3.2). This claim is explored in sub-chapters 19.3.1 and 19.3.2. These sections explore the design processes and procedures used as part of the Mechanical Engineering topic area and presents the contribution of these to Claim 2.2.10.1.

Claim 2.2.10.4: Mechanical SSC design incorporates Defence in Depth to protect against anticipated operational occurrences and accident conditions.

This section also includes discussion of how mechanical SSCs support the overall Defence in Depth of the SMR-300. The arguments and evidence supporting this rely on ongoing work to develop a Preliminary Engineering Schedule, which identifies the safety functional requirements of mechanical SSCs that support the lines of protection against accident sequences, as well as demonstration that mechanical SSCs deliver defence in depth.

19.3.1 Component Design Practices

Argument 2.2.10.1-A1: Holtec Design Standards incorporate relevant guidance into the requirements specifications of mechanical SSCs in the SMR-300.

Holtec's tiered requirements management structure includes the use of Design Standards, which are presented below. Design and requirements management are evidenced in PSR Part A Chapter 4 [13].

Holtec SMR-300 Design Standards are used to assign safety and architecture requirements to mechanical SSCs, such as the SMR-300 Design Standard for Radiation Protection [27] and the SMR-300 Design Standard for Grouping and Separation [28], among others. These design standards and the broader SMR-300 requirements management framework are presented in PSR Part A Chapter 4 [13]. The index of applicable project design standards is provided in PSR Part A Chapter 2 [11] and referenced from the GDA Design Reference Point Report [29].

These Design Standards establish key requirements across multiple areas that apply to mechanical SSCs. This chapter and supporting documents discuss these requirements (marked by *). Other requirements are discussed in referenced chapters. These topic areas and requirements are:

- Safety*.
- System performance*.
- Layout*:
    - Layout is a cross-cutting issue that is addressed across multiple Topic Areas.

  - Mechanical engineering supports the design philosophy and plant requirements as stated in the SMR-300 Top Level Plant Design Requirements [30].
  - Plant design control processes discussed in PSR Part A Chapter 4 include a section on SMR-300 layout.
- Reliability*:
  - High and Very High Reliability components are discussed in PSR Part B Chapter 18 Structural Integrity [21].
- EIMT*.
- Environmental qualification*.
- Grouping and separation*.
- Containment isolation*.
- Radiation protection*:
  - Some radiation protection requirements are achieved with methods other than Mechanical Engineering.
  - Mechanical Engineering will be relevant for Ventilation systems, hatches and other SSCs contributing to containment.
  - Radiation Protection related issues are presented in more detail in PSR Part B Chapter 10 Radiation Protection [6].
- External Hazards*:
  - For the most part, the civil structures provide protection from external hazards for the mechanical equipment within the plant. However, the seismic hazard affects all equipment within the plant, and external components such as HVAC intakes and outlets must be qualified as required against the effects of external hazards.
  - Mechanical Engineering will be relevant for the design of HVAC systems, in particular regard to maintaining suitable room conditions during extreme ambient air temperatures.
  - External hazard related issues are presented in more detail in PSR Part B Chapter 21 External Hazards [17].
- Internal Hazards*:
  - Mechanical SSCs both protect from and present several internal hazards.
  - The role of mechanical SSCs to protect against internal hazards are identified as functional and non-functional requirements of mechanical SSCs.
  - Internal hazard related issues are presented in more detail in PSR Part B Chapter 22 Internal Hazards [18].
- Seismic events, discussed in PSR Part B Chapter 20 Civil Engineering [15] and PSR Part B Chapter 21 External Hazards [17].
- Human Factors, covered in PSR Part B Chapter 17 Human Factors [31].
- Classification and System functions, covered in PSR Part B Chapter 14 Design Basis Accident Analysis [9].
- Severe Accident, covered in PSR Part B Chapter 15 Beyond Design Basis Analysis and Severe Accident Analysis, and Emergency Preparedness [22].
- Post-accident monitoring, covered in PSR Part B Chapter 4 Control and Instrumentation Systems [19].
- Instrumentation and Control, covered in PSR Part B Chapter 4 Control and Instrumentation Systems [19].

- Nuclear Site Health and Safety and Conventional Fire Safety, covered in PSR Part B Chapter 12 [14]:
    - This is supported by the CDM 2015 Strategy [32].

Many Mechanical Engineering design practices are used across the SMR-300, both due to the number of sub-disciplines and the variation in SSC classification. These are presented on a case-by-case basis in the Mechanical Engineering Design Basis Report [10], which presents mechanical SSCs, their functional performance requirements, safety requirements, and the design processes used.

Within individual sub-disciplines (or for the design of individual SSCs), varying workflows have been used to achieve SSC designs that meet these requirements.

This is explored in more depth in the Mechanical Engineering Design Basis Report [10], which identifies the design practices for individual SSCs and identifies design documentation demonstrating this for mechanical SSCs.

Regarding Claim 2.2.10.1, the evidence is appropriately mature to demonstrate Argument 2.2.10.1-A1 and this claim to the level expected for PSR.

19.3.2 Mechanical Design Against UK RGP

Argument 2.2.10.1-A2 supports Claim 2.2.10.1:

Argument 2.2.10.1-A2: Mechanical design processes have been reviewed against UK RGP to ensure it satisfies UK fault schedule needs, and any gaps are identified and appropriately tracked.

This argument is supported by the following evidence:

- DAC submissions related to Mechanical Engineering have identified risks in the design and presented options aligned with UK RGP to be incorporated into the design of mechanical SSCs. The Design Challenge and Design Adaptation Committee (DAC) process has been used for several Design Challenges throughout GDA Step 2 and will continue to be used to develop mechanical SSCs and Mechanical Engineering practices across the SMR-300. Design Challenges are presented in detail in sub-chapter 19.6.2.4.
    - Risks are identified where there is a potential difference between approach informed by US NRC guidance and UK RGP .
    - The risks discussed above are recorded on the Holtec SMR-300 Risk Register following the risk assessment and risk treatment processes [33].
    - These processes are discussed in greater detail in PSR Part A Chapter 4 [13].
- Commitments C_Mech_028 and C_Mech_094 (presented in sub-chapter 19.6.2.5) related to conducting gap analyses of the HVAC design and mechanical handling equipment against UK RGP.

Regarding Claim 2.2.10.1, the evidence is appropriately mature to demonstrate Argument 2.2.10.1-A2 and this claim to the level expected for PSR.

19.3.3 Defence in Depth

Mechanical SSCs make a significant contribution to Defence in Depth safety requirements across the SMR-300. Defence in Depth is a broader safety feature applied across the SMR-300 plant. The overarching approach to Defence in Depth is presented in PSR Part A Chapter 2 [11]. Mechanical SSCs contribute to Defence in Depth through specific design redundancy and diversity measures. This is outlined in Claim 2.2.10.4 stated at the start of this sub-chapter.

In support of Claim 2.2.10.4, Argument 2.2.10.4-A1 outlines the role of redundant mechanical SSCs to Defence in Depth:

Argument 2.2.10.4-A1: Where appropriate to the Defence in Depth of the SMR-300, mechanical SSCs with assigned safety functions have multiple, independent trains to deliver their safety function, providing redundant components as part of system design, to support the redundancy incorporated into the plant architecture. This redundancy is an integral part of the Defence in Depth of the SMR-300.

The evidence provided against this Argument includes the Mechanical Engineering Design Basis Report [10] and is further developed in the Preliminary Fault Schedule [8]. This will be further developed into a Preliminary Engineering Schedule as part of ongoing work, as identified in Commitment C_MSQA_111 presented in PSR Part A Chapter 4 [13]. An exemplar for the Preliminary Engineering Schedule is shown in Appendix B

[REDACTED].

Furthermore, there are examples of mechanical equipment designed with multiple trains to deliver functions and safety functions, which are presented in the Mechanical Engineering Design Basis Report [10]. Progress towards detailed assessment will include developing this argument to link to the evidence of individual SSCs with redundant features.

The full substantiation of this claim will follow the Fault Schedule and Engineering Schedule, which are not available at the release of PSR v1. These documents will demonstrate the faults identified for the SMR-300 and the lines of protection against each fault, which will demonstrate how Defence in Depth is applied across the design of the SMR-300. Examples of this can be seen in Appendix B, which demonstrates the safety functions protecting against a Medium Break Loss of Coolant Accident (LOCA) and filtered to a limited set of SSCs related to the Passive Core Makeup Water Tank (PCMWT).

Regarding Claim 2.2.10.4, the evidence is appropriately mature to demonstrate Argument 2.2.10.4-A1 and this claim to the level expected for PSR.

19.3.4 Functional Capability and Engineering Schedule

In support of Argument 2.2.10.4-A1, the following evidence is submitted or in progress:

- The Mechanical Engineering Design Basis Report [10] demonstrates the design features of mechanical SSCs that support the overall Defence in Depth of the plant.
- An illustrative example of an Engineering Schedule (which is shown in Appendix B) gives an indication of how a future Preliminary Engineering Schedule could be developed which aligns with the PFS.

As discussed in the Mechanical Engineering Design Basis Report, mechanical SSCs incorporate safety features which support the overall Defence in Depth of the SMR-300, including fail-safe features of mechanical SSCs to prevent faults arising from failure of mechanical SSCs or their interfaces from propagating.

As part of continued development from the Preliminary Fault Schedule [8], Holtec plans to develop an SMR-300 Preliminary Engineering Schedule outside of GDA, focused on those SSCs within scope of the GDA process. The Preliminary Engineering Schedule will continue to develop to cover all SSCs during site specific development of the Pre-Construction Safety Report (PCSR) and to support later project lifecycles. The Preliminary Engineering Schedule specifies the SFRs that SSCs satisfy and is developed iteratively throughout design development and GDA. Part A Chapter 4 recognises the importance of an engineering schedule for configuration management and contains a GDA commitment (C_MSQA_111) to develop and produce the engineering schedule.

The performance requirements outlined in the PFS are inputs to the Preliminary Engineering Schedule, identifying SSC loads in support of plant safety functions. At Fundamental Assessment / PSR stage, this is presented as part of the approach used to demonstrate safety of the GDA Reference SMR-300. This is under development and will follow development of the Fault Schedule from the current Preliminary Fault Schedule. An example of how functional capability of mechanical SSCs contributes to the Preliminary Engineering Schedule is shown in Appendix B

Regarding Claim 2.2.10.4, the evidence is appropriately mature to demonstrate Argument 2.2.10.4-A1 and this claim to the level expected for PSR.

19.3.5 CAE Summary

The SMR-300 design procedures for mechanical SSCs cover a broad scope of safety and operational related requirements. These design procedures ensure that mechanical SSCs deliver their safety functions and meet their safety requirements. Mechanical SSCs and their functional performance will be recorded in an Engineering Schedule, which identifies the functional performance requirements assigned to mechanical SSCs, and the substantiation of these SSCs against their requirements. The general approaches used have been discussed within this chapter, with more detail on how these have been implemented in the Mechanical Engineering Design Basis Report [10]. This supports Claim 2.2.10.1.

Mechanical SSCs support the Defence in Depth protections of the SMR-300 plant, with mechanical SSCs being designed with redundancy and diversity features. A breakdown of the redundancy approach per-SSC is given in the Mechanical Engineering Design Basis Report [10]. This supports Claim 2.2.10.4.

19.4 MECHANICAL ENGINEERING CODES AND STANDARDS

Claim 2.2.10.2: Mechanical SSCs are designed using appropriate Codes and Standards, taking cognisance of Relevant Good Practice (RGP) and Operating Experience (OPEX).

This section presents the supporting arguments and evidence to Claim 2.2.10.2, detailing the C&S used across the mechanical SSCs of the SMR-300. These C&S have been assessed against RGP and future activities have been identified to address gaps between the SMR-300 design and UK RGP. This claim is supported by three arguments, A1 relating to appropriate codes and standards used to design mechanical SSCs (sub-chapter 19.4.1), A2 that applicable OPEX is supported by robust sources (sub-chapter 19.4.2) and A3 which pertains to the alignment of codes and standards to UK RGP (sub-chapter 19.4.3).

19.4.1 Codes and Standards

To support Claim 2.2.10.2, Argument 2.2.10.2-A1 identifies the role of the C&S outlined in this section:

Argument 2.2.10.2-A1: The Codes and Standards that have been used in the design of mechanical SSCs in the SMR-300 are appropriate for developing nuclear power plants and their SSCs in the UK.

This argument is supported by evidence in the form of the Mechanical Engineering Codes and Standards Report [26]. This referenced report reviewed the C&S used across the SMR-300 mechanical SSCs and found that these C&S are considered to be RGP for the purposes they have been used.

The Mechanical Engineering Codes and Standards Report reviewed the C&S relevant to Mechanical Engineering used in the SMR-300 and reviewed whether these were appropriate to their application with regards to precedent or suitability within the UK context. The methodology used employed a simple hierarchy system rating each code or standard for risk against constituting UK RGP for their application. To summarise, the risk groups were defined as follows (in the order of increasing risk):

Table 2: Risk Group Definitions for Codes and Standards Review

Risk Group #	Definitions
Risk Group 1	Codes and Standards which have been used in comparable applications in the UK Nuclear sector, or are acknowledged within ONR guidance. This risk group is expected to represent UK RGP.
Risk Group 2	Codes and Standards which have been used in comparable applications in the US Nuclear sector, or are included in US NRC Guidance or US legislation. This risk group is expected to be RGP to developing PWRs, as the US nuclear regulatory scheme benefits from OPEX from the largest fleet of operating PWRs over several decades. For this reason, Holtec expect this to be acceptable as UK RGP.
Risk Group 3	Codes and Standards which are used in regulated, adjacent industries in the UK and US, including thermal power plants, Oil and Gas, etc. Codes and Standards in this risk group have higher risks and require additional review to assess their relevance to the UK nuclear sector before being suggested to meet UK RGP. If these do not meet Holtec's expectation of RGP, a design challenge will be raised around the relevant Codes and Standards for the applicable SSCs.
Risk Group 4	Codes and Standards which do not have use cases that are relevant to the UK nuclear sector. This risk group presents the highest risk and may require remediating actions beyond Step 2.

This report concludes that the majority of Mechanical codes and standards identified were found to either have precedence within other UK GDA and/or alignment with US NRC documentation and thus alignment between the C&S used and UK RGP. It is determined that there is confidence that the C&S used constitute UK RGP for the purposes they are applied. Three codes and standards were investigated further (Appendix C of [26]) as they were rated as 'Risk Group 3' and found that their applicability within the design is justifiable.

The C&S used to develop the SMR-300 are influenced by the US NRC and the Electric Power Research Institute: Utility Requirements Document for Advanced Light Water Reactors (EPRI URD). These C&S have been developed from OPEX of a large operating Pressurised Water Reactor (PWR) fleet.

Regarding Claim 2.2.10.2, the evidence is appropriately mature to demonstrate Argument 2.2.10.2-A1 and this claim to the level expected for PSR.

Claim 2.2.10.2 is further supported by Argument 2.2.10.2-A2, which identifies the nature of the C&S used to develop mechanical SSCs of the SMR-300:

Argument 2.2.10.2-A2: The SMR-300 mechanical SSCs are designed based on significant OPEX as collated in the EPRI URD and US NRC Regulatory Guides.

This argument is supported by the following evidence:

- PSR Part A Chapter 4 [13] presents the design management arrangements, including design inputs and requirements using guidance from the US NRC and the Electric Power Research Institute (EPRI) Utility Requirements Document (URD) for Advanced Light Water Reactors, which collates OPEX of a large operating fleet of Pressurised Water Reactors (PWRs)
- The Mechanical Engineering Design Basis Report [10] presents how Holtec Design Standards have been applied to mechanical SSCs.

Regarding Claim 2.2.10.2, the evidence is appropriately mature to demonstrate Argument 2.2.10.2-A2 and this claim to the level expected for PSR.

19.4.2 Gap Analysis and UK RGP

In support of Claim 2.2.10.2, Argument 2.2.10.2-A3 summarises how mechanical SSCs will be designed aligned with UK RGP.

Argument 2.2.10.2-A3: The Codes and Standards used to develop the SMR-300 are aligned with UK RGP and OPEX.

The evidence in support of Argument 2.2.10.2-A3 can be found in the Mechanical Engineering Codes and Standards Report [26]. There are additionally gaps against this argument that will be closed through commitments detailed below.

The C&S used to develop mechanical SSCs have been assessed for relevance and their use in similar applications in the UK. They were found to be suitable for the purposes in which they were applied [26]. However, the SMR-300 GDA project has also aimed to identify risks in the overall approach to design outside of the choice of C&S. Two risks were identified in the HVAC and Mechanical Handling topic areas where UK practice and legislation has the potential to require significant design change or additional justification and assessment.

Two commitments have been raised to address these risks: C_Mech_028 and C_Mech_094 are commitments to conduct gap analyses between the SMR-300 and identified UK RGP in the design of HVAC and Mechanical Handling SSCs, respectively. These commitments are presented in sub-chapter 19.6.2.5.

[REDACTED].

Regarding Claim 2.2.10.2, the evidence presented is appropriately mature to demonstrate Argument 2.2.10.2-A3 and this claim to the level expected for PSR. The gaps identified will be addressed by GDA commitments as discussed above

19.4.3 CAE Summary

The SMR-300 mechanical design has been undertaken using best practice nuclear industry C&S by use of the ASME Boiler and Pressure Vessel Code (BPVC), American Institute for Steel Construction (AISC), American Concrete Institute (ACI), American Society of Civil Engineers (ASCE)/Structural Engineering Institute (SEI) design codes. These have been assessed against several criteria, determining that they are relevant and appropriate for developing mechanical SSCs in the development of a nuclear power plant in the UK.

UK RGP is being reviewed to support additional risk reduction across the mechanical SSCs. This is being incorporated through gap analysis between the applied C&S and established UK RGP, as well as DBAA driven tasks to address risks (such as dropped loads as identified in Internal Hazards tasks, as part of Commitment C_Inte_096 in PSR Part B Chapter 22 [18])

Relevant UK legislation has been identified for mechanical SSCs as part of the Mechanical Codes and Standards report, while the design has not been assessed in detail to determine compliance with UK legislation, as this is outside of the scope of preliminary assessment. Future work in this area includes design development and gap analysis against UK RGP, which is the scope of commitments identified in 19.6.2.4. Where the findings of future tasks identify that Mechanical SSC designs do not comply with UK legislation, Prospective Design Changes will be raised to bring these SSC designs into compliance.

The Arguments and Evidence provided are suitably mature to support Claim 2.2.10.2 to level commensurate with the PSR, with identified gaps to be addressed by GDA commitments.

19.5 QUALITY MANUFACTURING AND INSTALLATION

Claim 2.2.10.3: Mechanical SSCs achieve the design intent through quality manufacturing, installation and EIMT processes.

This sub-chapter sets out how mechanical SSCs will in future be demonstrated to achieve their design intent and that the mechanical systems can provide the required functionality in the site environment.

The quality of mechanical SSCs will be ensured through stringent vendor selection and ongoing Quality Assurance (QA) and Quality Control (QC) measures throughout the manufacturing process and through the installation/commissioning process for the lifecycle of the SMR-300, which will be fully developed post-GDA. SMR-300 procedures for the selection of reputable and reliable contractors will be followed. Verification activities will demonstrate that the equipment has been manufactured correctly.

Mechanical Engineering is delivered in line with the SMR-300 Program Quality Plan, which is outlined in PSR Part A Chapter 4 [13]. Holtec has presented the arrangements for controlling the SMR-300 design and the arrangements to maintain a US Design Authority (DA).

This claim is supported by two arguments, A1 relating control processes to manage quality (sub-chapter 19.5.1 and 19.5.2) and A2 that show EIMT procedures in place (sub-chapter 19.5.3).

Argument 2.2.10.3-A1: The SMR-300 project has controls in place to ensure that the design, manufacturing and installation of mechanical SSCs maintain high quality standards throughout, in accordance with the SMR-300 Program Quality Plan.

This Argument is supported by the SMR-300 Program Quality Plan [34] as evidence. The SMR-300 Program Quality Plan defines several practices to ensure appropriately high quality across mechanical SSCs, as presented in sub-chapters 19.5.1 and 19.5.2.

19.5.1 Quality Assurance and Classification

Mechanical SSCs are classified in accordance with their safety significance, including quality and seismic classification, and are designed in accordance with the C&S appropriate to their identified classification. The classifications presented reflects the design at the release of the SMR-300 PSR (i.e., aligned with US NRC guidance on SSC classification), however a preliminary assessment of the classification of Mechanical SSCs against UK context expectations was undertaken. This assessment is presented in [REDACTED], summarised in Section 19.6.2.4.1 and concluded that the overall approach to SSC classification will be adjusted in line with Commitment C_Faul_103 shown in PSR Part B Chapter 14 [9].

The SSC classification methodology is defined in Chapter B14 [9] and assigns safety requirements and design standards to mechanical SSCs. The design codes used for mechanical SSCs are defined in sub-chapter 19.4.1, and are explored in greater detail in a supporting document: Mechanical Engineering C&S Report [26]. The C&S used have been assessed for either precedence in UK GDA or assessed the relative strengths or weaknesses of the C&S selected. This assessment is documented in the Mechanical Engineering C&S Report [26].

The SSC classification methodology is discussed in SMR-300 Systems, Structures, and Components Classification Standard [35]. This approach complies with NUREG 0800, and the Construction C&S defined in the NRC Quality Classification System, as shown in Table 3.

Table 3: Summary of Construction Codes and Standards for Components of Water-Cooled Nuclear Power Plants by NRC Quality Classification System

[REDACTED]

Note: "Plant ventilation systems for areas such as the control room and engineered safety features rooms" are recommended to be classified as Quality Group C as per supplemental guidance the NRC Quality Classification System [36].

By applying quality classes aligned with the US NRC Quality Classification System as discussed in this sub-chapter, mechanical SSCs can be seen to achieve high quality standards as set out in the SMR-300 Program Quality Plan.

Regarding Claim 2.2.10.3, the evidence is appropriately mature to demonstrate Argument 2.2.10.3-A1 and this claim to the level expected for PSR.

19.5.2 Manufacturing and Fabrication

The generic SMR-300 design utilises modular construction techniques where possible for the twin unit site. Mechanical SSCs include bespoke components fabricated by Holtec International and their supply chain, and COTS items. These SSCs are subject to the SMR-300 Project Quality Plan [34], which includes procedures to select and maintain suppliers, conformance testing, Quality Assurance (QA) records, and audits, among other Holtec Quality Procedures.

Procurement of safety significant scope of work from a supplier requires that either the supplier is registered on the Holtec Approved Vendors List (AVL), or the company performs dedication/upgrades to their controls to qualify the products within a scope of work. Suppliers are approved based upon recommendations, certifications and experience, qualification of suppliers within Holtec's QA program through auditing, or extension of Holtec's QA program for performance of supplier scope.

By applying these Holtec Quality procedures, mechanical SSCs will achieve code compliance with RGP C&S. These C&S, including for example ASME Section III, incorporate requirements ensuring high quality manufacturing and fabrication. This is achieved through utilising the Holtec AVL, which incorporates suppliers which are certified to manufacture and fabricate to nuclear safety classified components as defined in ASME Section III.

By establishing processes to ensure components are manufactured and fabricated to high standards, mechanical SSCs can be seen to achieve high quality standards as set out in the SMR-300 Program Quality Plan

Regarding Claim 2.2.10.3, the evidence is appropriately mature to demonstrate Argument 2.2.10.3-A1 and this claim to the level expected for PSR.

19.5.3 Examination, Inspection, Maintenance, and Testing

The following Argument supports Claim 2.2.10.3 by presenting how EIMT supports the operations of the SMR-300:

Argument 2.2.10.3-A2: The SMR-300 is designed with appropriate EIMT procedures to ensure that mechanical SSCs will continue to meet their design intent throughout the life of an SMR-300 plant, including appropriate access space, maintenance routes, inspection methods.

This argument is supported by the following evidence:

- EIMT Regime.
- Outage Strategy.
- Future evidence: COMS Review Process.

[REDACTED]

19.5.4 CAE Summary

The QA requirements for mechanical SSCs are defined in respective SSC design specifications. These QA requirements must be satisfied in manufacturing / fabrication, as well as through life by using EIMT. Claim 2.2.10.3 is underpinned by the RP's processes established to ensure mechanical SSCs meet high quality standards, including rigorous QA processes. The RP has established processes to ensure that the SMR-300 will use high-quality standards through manufacturing, installation and maintenance processes. The evidence presented is appropriately mature to demonstrate Claim 2.2.10.3 and supporting Arguments to the level expected for PSR.

19.6 CHAPTER SUMMARY AND CONTRIBUTION TO ALARP

This sub-chapter provides an overall summary and conclusion of the Mechanical Engineering chapter and how this chapter contributes to the overall demonstration of ALARP for the generic SMR-300. Chapter A5 [37] sets out the overall approach for demonstration of ALARP and how contributions from individual chapters are consolidated.

This sub-chapter therefore consists of the following elements:

- Technical Summary.
- ALARP Summary.
    - Demonstration of Relevant RGP.
    - Evaluation of Risk and Demonstration Against Risk Targets.
    - Options Considered to Reduce Risk.
- GDA Commitments.
- Conclusion.

A review against these elements is presented below under the corresponding headings.

19.6.1 Technical Summary

PSR Part B Chapter 19 aims to demonstrate the following Level 3 claim to a maturity appropriate for a PSR:

Claim 2.2.10: The overall design and architecture of mechanical SSCs ensures that safety functions and non-safety functions are delivered and faults arising from failures of the SSCs are minimised.

This claim has several aspects which are addressed by several Level 4 claims as discussed in this PSR chapter. These Level 4 claims are shown in Table 1, and demonstrate the following aspects that support Claim 2.2.10.

The RP has established suitable design processes and procedures to ensure that appropriate requirements are captured in the development of mechanical SSCs. These processes and procedures are used across multiple topic areas and are discussed in sub-chapter 19.3, with relevant information demonstrated in the Mechanical Engineering Design Basis Report [10].

The C&S used to develop mechanical SSCs have been discussed in the Mechanical Engineering Codes and Standards report and presented in sub-chapter 19.4. This demonstrates the C&S that have been used to inform the design of mechanical SSCs and discusses whether these C&S are likely to constitute UK RGP. Claim 2.2.10.2 is also supported by ongoing work to review UK RGP and identify gaps within the Mechanical C&S, as discussed in relation to Design Challenges (sub-chapter 19.3.2).

The processes and procedures that the RP has established extend to manufacturing, installation, and maintenance, which is discussed in sub-chapter 19.5. These processes will ensure that mechanical SSCs deliver their design basis throughout the design life of an SMR-300 unit. While several aspects of this are out of scope of GDA due to design maturity, the high-quality standards required of the SMR-300 Program Quality Plan and the relevant design processes supporting this provide evidence that Claim 2.2.10.3 can be achieved.

In relation to Claim 2.2.10.1 and specifically in support of Claim 2.2.10.4, mechanical SSCs have safety requirements to deliver Defence in Depth and support the designed resilience of the SMR-300. This includes engineered Defence in Depth of mechanical SSCs, which is in support of the plant architecture that incorporates Defence in Depth of different SSCs. An example of this is shown in sub-chapter 19.3.3, and more broadly will be developed through developing from the Preliminary Fault Schedule [8], to a full Fault Schedule, Preliminary Engineering Schedule and full Engineering Schedule.

19.6.2 ALARP Summary

This section provides a summary of how Mechanical Engineering has been used to reduce risks across the SMR-300 plant. This section is informed from supporting GDA documents, primarily the Mechanical Engineering Design Basis [10], Codes and Standards [26] reports and the Mechanical Engineering ALARP summary report [38].

19.6.2.1 Demonstration of RGP

C&S have been assessed as meeting RGP by reviewing three sources:

- Codes, standards or methodologies used in prior technologies receiving a GDA Design Acceptance Confirmation / Statement of Design Acceptability.
- Codes or standards identified in international regulatory guidance.
- Codes or standards identified in UK regulatory guidance (specifically Technical Assessment Guidance).

The Mechanical Engineering C&S Report [26] shows this comparison between the C&S used and RGP. The Mechanical Engineering C&S Report [26] also compares the C&S used with comparable C&S to evaluate whether the choice of C&S has reduced risks. This has determined that the C&S used to develop mechanical SSCs are appropriate for use in the UK, constitute RGP for the purposes they have been used, and support an ALARP design for the SMR-300.

19.6.2.2 Design Methodologies

The Mechanical Engineering discipline implements common design practices used across the SMR-300 project which have clear direction to reduce or eliminate risk in SSC designs. By establishing common design methodologies that reduce risk, the SSCs developed using these methodologies have reduced risks in their design and in the arrangement of SSCs in the plant.

These methods include the following high-level methodologies:

- SMR Procedure for Evaluating and Performing Design Decisions [39]:
    - This establishes a process to manage design changes across the SMR-300 project.
- UK specific process: Approach to Prospective Design Change (UK).
- SMR-300 Defence in Depth Strategy:
    - This document defines the Defence in Depth strategy for the plant, and the requirements placed on mechanical SSCs to support this through Redundancy and Diversity requirements.
- SMR-300 Design Standards establishing requirements for:

- Human Factors: Maintenance, Inspection, and Testing (current documentation is for SMR-160) [40].
- Radiation Protection [27].
- Severe Accident Requirements [41].
- Application of Single Failure Criterion [42].
- Grouping and Separation [28].
- Fire Protection [43]

A summary of these processes, practices and methods, with examples of outcome, can be found in [38]. As SSCs are developed, the designs for these SSCs are verified as appropriate to the level of maturity.

As outlined in sub-chapter 19.3.2, the design decision process is used to manage and guide design decisions to incorporate UK RGP. This process balances multiple aspects of power plant design, balancing risk reduction and practicability.

19.6.2.3 Evaluation of Risk and Demonstration Against Risk Targets

The numerical targets against which the demonstration of ALARP is considered can be found in PSR Part A Chapter 2 [11].

Mechanical SSCs, through the defined safety functions, will contribute to the demonstration of ALARP by comparison against the risk targets in two ways:

- By fulfilling safety functions for normal operations and thereby contributing to achieving Targets 1-3;
- By achieving their safety classification as a duty system or a protection system, where claimed, they will contribute to reduction of risk from faults and accidents to an ALARP level, Targets 4-9.

The safety classification of mechanical SSCs will be considered alongside a Probability of Failure on Demand (PFD) and Probability of Failure per Annum (PFA), which is then used to calculate the overall comparison against the risk targets as described above.

The evaluation of the normal operations and accident risks against Targets 1-9 is summarised in Part A Chapter 5 [37].

19.6.2.4 Options Considered to Reduce Risk

Risk reduction is core to SMR-300 development. Holtec maintains a design decision register as part of the SMR-300 project, as well as a separate process for the GDA Reference SMR-300 Design: Prospective Design Change Procedure [44].

Two separate aspects contribute to risk reduction from the Mechanical Engineering topic area: Design Decision Process, and the Design Challenge process. These are discussed in PSR Part A Chapter 5 [37].

There are several design challenges that have been developed from the Mechanical Engineering Topic Area. Their contribution to ALARP has been discussed below.

19.6.2.4.1 Mechanical SSC Classification

[REDACTED]

Holtec will fulfil commitment C_Faul_103 in PSR Part B Chapter 14 [9] to address the design challenge, which includes undertaking Design Basis Accident Analysis (DBAA) and incorporate the results into the design of the SMR-300.

19.6.2.4.2 HVAC Architecture, Design Codes and Design Basis

[REDACTED]

This design challenge has led to a commitment (C_Mech_028) to conduct gap analysis against UK RGP and incorporate these into the design of HVAC systems.

19.6.2.4.3 Motor Operated Valve (MOV) Diversity

[REDACTED]

Arrangement and selection of safety-related valves will be considered proportionately to risk and in line with Commitment C_Faul_103 in Part B Chapter 14 [9].

19.6.2.4.4 60/50Hz Strategy

DAC paper title: 60/50Hz Design Challenge [45]

This paper presents the 60/50Hz Strategy [46] and presents options to the DAC. This decision was led by the Electrical Engineering topic area, and several mechanical SSCs use mains Alternating Current (AC) power and require adaptation to deployment in power grids with a different AC operating frequency to that in the US. This Design Challenge identifies the issues associated with 50Hz power supplies and discusses options for adapting the design to the UK.

[REDACTED]

19.6.2.5 GDA Commitments

GDA commitments which relate to this chapter have been formally captured in the Commitments, Assumptions and Requirements process [12]. Further details of this process are provided in Part A Chapter 5 [13].

At Revision 1, two commitments have been made against the Mechanical Engineering topic area, as shown in Table 4.

Table 4: Post-GDA Commitments

ID	Description	Dependencies
C_Mech_028	A high level gap analysis has determined that UK RGP differs from the US approach to designing HVAC SSCs in several areas of mechanical design, including requirements related to Fire Protection, Radiation Protection, EC&I, External Hazards, and SSC classification. A Commitment is raised to review and incorporate UK RGP into the design of HVAC SSCs in the UK SMR-300 where it is practicable. Target for resolution: Issue of UK Pre-Construction SSEC.	Design Basis Accident Analysis / Fault Schedule
C_Mech_094	A high level gap analysis has determined that UK RGP differs from the US approach in several areas of design of mechanical handling and lifting equipment, including drop load assessments, as well as needing to consider additional legislation such as LOLER and PUWER, and CDM arrangements. A Commitment is raised to review and incorporate UK RGP where practicable, and to incorporate requirements from UK legislation into the design of UK SMR-300 lifting equipment. Target for resolution: Issue of UK Pre-Construction SSEC.	Design Basis Accident Analysis / Preliminary Fault Schedule, Internal Hazards dropped loads assessment (C_Inte_096).

Commitments are presented in the Commitments, Assumptions and Requirements register.

19.6.3 Conclusion

This chapter presents and discusses the claims supported by the Mechanical Engineering topic area. As Mechanical Engineering is a broad subject covering many aspects of the SMR-300, the claims focus on how the practice of Mechanical Engineering has contributed to the design of the SMR-300 and how risks have been reduced across the design.

The primary claim for the chapter (Claim 2.2.10, a Level 3 claim) is supported by four claims (at Level 4) related to different aspects of Mechanical Engineering and range from design processes, procedures and codes to assured quality in manufacturing and installation. At this stage of development, there are CAE supporting Claim 2.2.10 to a level appropriate for a PSR, as shown in Appendix A.

This PSR chapter and the supporting documents present the aspects of Mechanical Engineering in the fundamental design of the SMR-300. There are several noted areas of development in the Mechanical Engineering topic area to address identified risks. These risks include gaps between the US and UK regulatory approaches and areas of development for the SMR-300. Project processes are available to identify and escalate these risks into Design Challenges and Prospective Design Changes and have currently been used to raise three Design Challenges in the Mechanical Engineering topic area, as well as further Design Challenges in interfacing topic areas. There are further commitments to review UK RGP and incorporate requirements into HVAC and lifting equipment where appropriate.

The Design Challenges and Commitments will be developed in accordance with the principles of ALARP and the ALARP considerations are discussed in the context of the overall SMR-300 design in an overarching ALARP summary statement in Part A Chapter 5 [37]. The information presented has included risk reduction activities across the design of the SMR-300, which will be further developed in accordance with the principles of ALARP.

It is therefore judged that the safety of the SMR-300 relying on Mechanical Engineering demonstrated at an appropriate level for a PSR, subject to resolution of the commitments.

19.7 REFERENCES

[1] Holtec Britain, “HI-2240332, Holtec SMR GDA PSR Part A Chapter 1 Introduction,” Revision 1, July 2025.

[2] Holtec Britain, “HI-2240334, Holtec SMR GDA PSR Part A Chapter 3 Claims, Arguments and Evidence,” Revision 1, July 2025.

[3] Holtec Britain, “HI-2240337, Holtec SMR GDA PSR Part B Chapter 1 Reactor Coolant System and Engineered Safety Features,” Revision 1, July 2025.

[4] Holtec Britain, “HI-2240776, Holtec SMR GDA PSR Part B Chapter 2 Reactor,” Revision 1, July 2025.

[5] Holtec Britain, “HI-2240777, Holtec SMR GDA PSR Part B Chapter 5 Reactor Supporting Facilities,” Revision 1, July 2025.

[6] Holtec Britain, “HI-2240341, Holtec SMR GDA PSR Part B Chapter 10 Radiological Protection,” Revision 1, July 2025.

[7] Holtec Britain, “HI-2240344, Holtec SMR GDA PSR Part B Chapter 13 Radioactive Waste Management,” Revision 1, July 2025.

[8] Holtec Britain, “HI-2241323, Preliminary Fault Schedule Report,” Revision 1, 2025.

[9] Holtec Britain, “HI-2240345, Holtec SMR GDA PSR Part B Chapter 14 Safety/Design Basis Accident Analysis,” Revision 1, July 2025.

[10] Holtec Britain, “HI-2250097, SMR-300 Mechanical Engineering Design Basis Report,” Revision 0, March 2024.

[11] Holtec Britain, “HI-2240333, Holtec SMR GDA PSR Part A Chapter 2 General Design Aspects and Site Characteristics,” Revision 1, July 2025.

[12] Holtec Britain, “HPP-3295-0013, Holtec SMR-300 Generic Design Assessment Capturing and Managing Commitments, Assumptions and Requirements,” Revision 1, January 2025.

[13] Holtec Britain, “HI-2240335, Holtec SMR GDA PSR Part A Chapter 4 Lifecycle Management of Safety and Quality Assurance,” Revision 1, July 2025.

[14] Holtec Britain, “HI-2240343, Holtec SMR GDA PSR Part B Chapter 12 Nuclear Site Health and Safety and Conventional Fire Safety,” Holtec Britain, 2025.

[15] Holtec Britain, “HI-2240357, Holtec SMR GDA PSR Part B Chapter 20 Civil Engineering,” Revision 1, July 2025.

[16] Holtec Britain, "HI-2240353, Holtec SMR GDA PSR Part B Chapter 24 Fuel Transport and Storage," Revision 1, July 2025.

[17] Holtec Britain, "HI-2240350, Holtec SMR GDA PSR Part B Chapter 21 External Hazards," Revision 1, July 2025.

[18] Holtec Britain, "HI-2240351, Holtec SMR GDA PSR Part B Chapter 22 Internal Hazards," Revision 1, July 2025.

[19] Holtec Britain, "HI-2240338, Holtec SMR GDA PSR Part B Chapter 4 Control and Instrumentation Systems," Revision 1, July 2025.

[20] Holtec Britain, "HI-2240339, Holtec SMR GDA PSR Part B Chapter 6 Electrical Engineering," Revision 1, July 2025.

[21] Holtec Britain, "HI-2240349, Holtec SMR GDA PSR Part B Chapter 18 Structural Integrity," Revision 1, July 2025.

[22] Holtec Britain, "HI-2240346, Holtec SMR GDA PSR Part B Chapter 15 BDBA, Severe Accidents Analysis and Emergency Preparedness," Revision 1, July 2025.

[23] Holtec Britain, "HI-2240347, Holtec SMR GDA PSR Part B Chapter 16 Probabilistic Safety Assessment," Revision 1, July 2025.

[24] Holtec Britain, "HI-2240340, Holtec SMR GDA PSR Part B Chapter 9 Description of Operational Aspects/Conduct of Operations," Revision 1, July 2025.

[25] Holtec Britain, "HI-2240342, Holtec SMR GDA PSR Part B Chapter 11 Environmental Protection," Revision 1, July 2025.

[26] Holtec Britain, "HI-2241408, Mechanical Codes and Standards Report," Revision 0, December 2024.

[27] Holtec International, "HPP-8002-0026, SMR-300 Design Standard for Radiation Protection," Revision 0, 2025.

[28] Holtec International, "HPP-8002-3017, Design Standard for Grouping and Separation," Revision 0, March 2024.

[29] Holtec Britain, "HI-2240648, Holtec SMR-300 GDA Design Reference Point," Revision 2, May 2025.

[30] Holtec International, "HI-2240251 SMR-300 Top Level Plant Design Requirements," Holtec International, Revision 2, January 2024.

[31] Holtec Britain, "HI-2240348, Holtec SMR GDA PSR Part B Chapter 17 Human Factors," Revision 1, July 2025.

[32] Holtec Britain, "HI-2241088, Construction (Design and Management) 2015 Strategy," Revision 0, November 2025.

[33] Holtec Britain, "HPP-3295-0023, Holtec Britain Security Risk Assessment, Risk Register and Risk Treatment Plan," Revision 0, April 2024.

[34] Holtec International, "HPP-8002-0002, SMR-300 Program Quality Plan," Revision 0, April 2024.

[35] Holtec International, "HPP-8002-0012, SMR-300 Systems, Structures, and Components Classification Standard," Revision 0, April 2025.

[36] United States Nuclear Regulatory Commission, "NUREG-0800, Chapter 3.2.2: System Quality Group Classification," 2016.

[37] Holtec Britain, "HI-2240336, Holtec SMR GDA PSR Part A Chapter 5 Summary of ALARP and SSEC," Revision 1, July 2025.

[38] Holtec Britain, "HI-2250099, Mechanical Engineering ALARP Summary Report, Revision 0," 2024.

[39] Holtec International, "HPP-160-3008, SMR-160 Procedure for Evaluating and Performing Design Decisions," Revision 0, October 2017.

[40] Holtec International, "HPP-160-3016, SMR-300 Design Standard for Human Factors: Maintenance, Inspection and Testing Revision 0," 2025.

[41] Holtec International, "HPP-160-3018, SMR-160 Design Standard for Severe Accident Requirements," Revision 0, August 2019.

[42] Holtec International, "HPP-160-3019, SMR-160 Design Standard for Application of Single Failure Criterion," Revision 0, March 2019.

[43] Holtec International, "HPP-160-3014 SMR-300 Design Standard for Fire Protection," Revision 0, March 2019.

[44] Holtec Britain, "HPP-3295-0017, Design Management, Revision 1," 2024.

[45] Holtec Britain, "HI-2241520, UK GDA [DC28] Design Challenge - 60/50Hz Design Challenge," 2025.

[46] Holtec Britain, "HI-2241517, Holtec SMR-300 GDA 60/50Hz Strategy, Revision 0," 2025.

19.8 LIST OF APPENDICES

Appendix A PSR Part B Chapter 19 CAE Route Map

The lines in Table 5 have evidence in Blue where these are available at PSR v1, and Red where these are planned areas for development after PSR v1.

Table 5: Part B Chapter 19 CAE Route Map

[REDACTED]

Appendix B Engineering Schedule Illustrative Example.

[REDACTED]

Table 6: Engineering Schedule (Example)

[REDACTED]