HOLTEC BRITAIN

A Holtec International Company

Holtec Britain Ltd	HI-2240343
Sponsoring Company	**Document Reference**
1	23 September 2025
Revision No.	**Issue Date**
Report	Non-proprietary
Record Type	**Proprietary Classification**
ISO 9001	No
Quality Class	**Export Control Applicability**

Record Title:

PSR Part B Chapter 12 Nuclear Site Health and Safety and Conventional Fire Safety

Proprietary Classification

This record does not contain commercial or business sensitive information.

Export Control Status

Export Control restrictions do not apply to this record.

Revision Log

Revision	Description of Changes
0	First Issue to Regulators to support PSR v0
1	Second Issue to Regulators to support PSR v1

Table of Contents

List of Tables

12.1 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 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 intended evidence 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 12 of the PSR presents the Claims, Arguments and Evidence (CAE) for two topics, nuclear site health and safety and conventional fire safety.

12.1.1 Purpose and Scope

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

This chapter (Part B Chapter 12) links to the overarching claim through Claim 2.3:

Claim 2.3: The design and safety assessment of the generic SMR-300 considers the entire reactor lifecycle.

As set out in Part A Chapter 3 [2], Claim 2.3 is further decomposed across several disciplines which support the development of through-life management arrangements.

This chapter presents the Nuclear Site Health and Safety and Conventional Fire Safety topics for the generic SMR-300 and therefore directly supports Claim 2.3.5.

Claim 2.3.5: Nuclear site health and safety and conventional fire safety are managed to ensure that the conventional health and safety risks, and fire safety risks to workers and the public are reduced so far as is reasonably practicable.

Further discussion on how the Level 3 claim is broken down into Level 4 claims and how the Level 4 claims are met is provided in sub-chapter 12.3. The scope of this chapter covers Nuclear Site Health and Safety and Conventional Fire Safety as set out in the following sub-chapters:

- Sub-chapter 12.3 covers an overview of the Nuclear Site Health and Safety and Conventional Fire Safety claims, arguments and evidence.
- Sub-chapter 12.4 covers the codes and standards associated with Nuclear Site Health and Safety.
- Sub-chapter 12.5 covers the arguments and evidence associated with the level 4 claim, 2.3.5.1 relating to Nuclear Site Health and Safety.
- Sub-chapter 12.6 covers the code and standards associated with conventional fire safety.

- Sub-chapter 12.7 covers the arguments and evidence associated with the level 4 claim, 2.3.5.2 relating to conventional fire safety.
- Sub-chapter 12.8 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. This sub-chapter also discusses any GDA commitments that have arisen.

A master list of definitions and abbreviations relevant to all PSR chapters can be found in Part A Chapter 2 [3].

12.1.2 Assumptions

Assumptions which relate to this topic have been formally captured through the GDA Commitments, Assumptions and Requirements process [4]. Further details of this process are provided in Part A Chapter 4.

There are no assumptions raised in relation to Part B Chapter 12.

12.1.3 Interfaces with other SSEC Chapters

This PSR chapter covers conventional safety. Due to the specialism and specific requirements of conventional fire safety, the topics of nuclear site health and safety and conventional fire safety are split out in this chapter and dealt with separately. However, it is recognised that nuclear site health and safety and conventional fire safety interface. For example, conventional fire safety is one input and output of design risk reviews, led by nuclear site health and safety. Fire risks are usually addressed alongside conventional health and safety risks in building layout reviews, and risks associated with the Dangerous Substances and Explosive Atmospheres Regulations 2002 [5].

The Nuclear Site Health and Safety and Conventional Fire Safety chapter interfaces with the following PSR chapters.

12.1.3.1 Nuclear Site Health and Safety

Nuclear Site Health and Safety is one of the key cross-cutting topics of the PSR. Throughout GDA Step 2, the Nuclear Site Health and Safety team have worked closely with these interfacing topics in the production of GDA Step 2 deliverables. During the production of this PSR revision, reviews of key interfacing chapters were undertaken to ensure conventional health and safety was well represented. Nuclear Site Health and Safety interfaces with the following PSR chapters.

PSR Part A Chapter 4 [6] interfaces with Nuclear Site Health and Safety in design management and organisational elements, such as nuclear safety culture and competence.

PSR Part B Chapter 9 [7], Claim 2.3.1.3 is related to Examination, Inspection, Maintenance and Testing (EIMT) of the SMR-300's System, Structures and Components (SSCs). SSCs will be designed to eliminate or mitigate conventional health and safety risks related to EIMT, So Far As Is Reasonably Practicable (SFAIRP). Also, Nuclear Site Health and Safety interfaces with PSR Part B Chapter 17 [8] when considering EIMT as sufficient access, space and a suitable working environment must be provided to workers to facilitate safe, effective conduct of these activities.

PSR Part B Chapter 19 [9] and Chapter 20 [10] interface with Nuclear Site Health and Safety as mechanical and civil SSCs will be designed in compliance with the Construction (Design and Management) Regulations 2015 (CDM 2015) [11], in-line with the Holtec Britain CDM Strategy [12]. This ensures that the SMR-300's SSCs will be constructed, installed, examined, maintained, inspected, tested, repaired, replaced, decommissioned and deconstructed safely.

Nuclear Site Health and Safety is relevant to the full lifecycle of the SMR-300 and Holtec will manage conventional health and safety risks to each phase through design activities. The Construction and Commissioning phases and the Decommissioning Approach are described in PSR Part B Chapter 25 [13] and 26 [14] respectively.

Conventional health and safety risks related to construction, installation, EIMT, replacement, decommissioning and deconstruction of SSCs are managed during design activities carried out by Holtec. Therefore, other interfacing chapters that will carry out design activities include PSR Part B Chapter 4 [15], 6 [16] and 18 [17].

PSR Part B Chapter 10 [18] is an interface when considering designing for maintenance and decommissioning such that dose and contamination risk is controlled.

PSR Part B Chapter 22 [19] will input into design risk reviews as internal hazards often pose a conventional health and safety risk.

Preliminary Environmental Report (PER) Conventional Impact Assessment Chapter 4 [20] and Nuclear Site Health and Safety interface due to the Control of Major Accident Hazards (COMAH) Regulations [21]. A COMAH Screening Assessment was produced as a GDA Step 2 deliverable. Conventional environmental risks are usually addressed in design risk reviews addressing Best Available Techniques associated with the avoidance of spills and leaks, for example.

12.1.3.2 Conventional Fire Safety

Conventional fire safety shares a common objective within nuclear fire safety (included as part of the Internal Hazards discipline in PSR Part B Chapter 22), which is the elimination or reduction of the effects and risks associated with fire occurring on the site. The fire protection features included within the design normally contribute towards both disciplines and associated claims.

There have also been some initial high-level interface discussions with Mechanical Engineering (included in PSR Part B Chapter 19) relating to the proposals for pressurisation of escape routes and Human Factors (included in PSR Part B Chapter 17) for the early estimation of occupant numbers.

12.2 OVERVIEW OF NUCLEAR SITE HEALTH AND SAFETY AND CONVENTIONAL FIRE SAFETY

12.2.1 Nuclear Site Health and Safety

Nuclear Site Health and Safety covers the consideration of conventional/non-nuclear health and safety associated with a nuclear site.

A key aspect of managing any construction project or facility is conventional health and safety. This is especially important on a high-hazard site such as a new-build nuclear power generation facility. Nuclear Site Health and Safety in the UK is governed by UK law and regulation, including both goal-setting and prescriptive philosophies. This is relevant to all SSCs, throughout the full lifecycle of the SMR-300 and all phases must be considered during design. For the SMR-300 project phase convention, refer to PSR Part A Chapter 4 [6].

The Health and Safety at Work etc. Act [22] is the top-tier legislation in the UK covering occupational health and safety which sets out the goal-setting philosophy by which health and safety risks are reduced SFAIRP. The CDM 2015 [11] regulations, which are based on the same philosophy, cover the full lifecycle of construction projects, with onus on controlling hazards and risks in the design phase. In parallel, there is a suite of health and safety regulations covering specific activities, such as Work at Height [23], where prescriptive rules and goal-setting requirements are defined.

Holtec International has developed the SMR-300 up to the Design Reference Point (DRP) under International Organization for Standardization (ISO) 45001 [24] certification. For a description of the DRP and the arrangements underpinning the GDA DRP refer to PSR Part A Chapter 2 [3] and PSR Part A Chapter 4 [6]. ISO 45001 sets out requirements for conventional health and safety management systems. Holtec ensure compliance with ISO 45001 through the Environmental, Health and Safety Management System Manual [25].

[REDACTED]

12.2.2 Conventional Fire Safety

An important aspect in the design and licensing of nuclear facilities is conventional fire safety and the incorporation of elements and measures to provide plant workers and fire intervention personnel, protection from the effects of fire in line with legislative requirements.

The requirements stemming from the development of conventional fire safety strategies can be far reaching and impact disciplines such as architecture, structure, fire protection, internal hazards, Heating, Ventilation, and Air Conditioning (HVAC), electrical systems, security, etc. Due to the cross-cutting nature of conventional fire safety and particularly the risk of structural changes being needed, Office for Nuclear Regulation (ONR) GDA guidance [26] suggests that the focus of conventional fire safety studies during GDA is on aspects of the design that could challenge the structure, in effect de-risking the design against major structural changes being needed post GDA. Thus, SSCs important to conventional fire safety studies during the GDA stage are the building structures CS, CES, IB, and RAB.

[REDACTED]

SMR-300 has been developed in the US based on the incorporation of recommendations from the National Fire Protection Association (NFPA) Standards, primarily 804 [27] and 101 [28], which provides assurance that the level of fire safety afforded to plant workers and fire intervention personnel will be of a similar standard to that expected in the UK, as:

- NFPA standards are mature standards like their UK counterparts Approved Document B [29] and BS 9999 [30].
- Whilst developed in the US, predominantly for the US market, NFPA standards are adopted and applied on projects globally.
- Societal expectations for fire life safety are similar between the UK and the US.

Unlike most buildings in the UK, the Building Regulations [31] are generally not enforceable to the buildings on a licensed nuclear facility, and instead the primary UK legislation governing the level of conventional fire safety required stems from the Health and Safety at Work etc. Act [22] and the requirement therein that risks are reduced SFAIRP. As per general practices in the UK nuclear industry, reference is made to ALARP instead of SFAIRP.

Furthermore, as per ONR guidance [26] it is assumed that the application of Relevant Good Practice (RGP) ensures that risks are reduced to ALARP, and thus only the differences between the design and RGP need qualitative and/or quantitative assessment (within the ALARP framework). The demonstration that risks have been reduced to ALARP adds an additional layer of rigour to the development of a fire strategy.

The emphasis of conventional fire safety during GDA has been placed on the development of a high-level fire strategy that may be developed further post GDA without major changes to the building structure being needed. PSR activities are therefore, considered as an essential step in the development of a robust conventional fire safety strategy that will afford a high level of fire safety to plant workers and fire intervention personnel.

12.3 NUCLEAR SITE HEALTH AND SAFETY AND CONVENTIONAL FIRE SAFETY CLAIMS, ARGUMENTS AND EVIDENCE

This chapter presents the Nuclear Site Health and Safety and Conventional Fire Safety aspects for the generic SMR-300 and therefore directly supports Claim 2.3.5.

Claim 2.3.5: Nuclear site health and safety and conventional fire safety are managed to ensure that the conventional health and safety risks, and fire safety risks to workers and the public are reduced so far as is reasonably practicable.

Claim 2.3.5 has been further decomposed within Part B Chapter 12 into two level 4 claims, one specific to nuclear site health and safety and the other to conventional fire safety; separate level 4 claims allow clear concise arguments to be made for each, to provide confidence that relevant requirements for each topic will be met during all lifecycle phases.

Table 1 shows the breakdown of Claim 2.3.5 and identifies in which chapter of this PSR these claims are demonstrated to be met to a maturity appropriate for PSR v1.

Table 1: Claims Covered by Chapter B12

Claim No.	Claim	Chapter Section
2.3.5.1	The generic Holtec SMR-300 is designed such that Nuclear Site Health and Safety risk is demonstrated to be reduced so far as is reasonably practicable using the hierarchy of risk control throughout the plant lifecycle.	Section 12.4 Nuclear Site Health and Safety Codes And Standards / Methodologies and Section 12.5 Nuclear Site Health and Safety Assessment
2.3.5.2	The generic Holtec SMR-300 is designed so that occupants are able to evacuate their building safely, without assistance; and that the fire and rescue service can undertake firefighting activities in the event of a fire.	Section 12.6 Conventional Fire Safety Codes and Standards / Methodologies and Section 12.7 Conventional Fire Safety

Appendix A provides a full claims, arguments and evidence mapping for Chapter B12, which includes lower-level claims, arguments and the evidence needed to support the claims listed 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.

12.4 NUCLEAR SITE HEALTH AND SAFETY CODES AND STANDARDS / METHODOLOGIES

Claim 2.3.5.1: The generic Holtec SMR-300 is designed such that Nuclear Site Health and Safety risk is demonstrated to be reduced so far as is reasonably practicable using the hierarchy of risk control throughout the plant lifecycle.

Claim 2.3.5.1 has been further decomposed into five arguments. One argument to address the claim is set out in this section.

Argument 2.3.5.1 – A1: Goal-setting and prescriptive UK health and safety relevant good practice has been identified for the assessment of nuclear site health and safety in the deployment of the SMR-300 in the UK.

Evidence for Claim 2.3.5.1 – A1:

- **HI-2241088, Holtec CDM Strategy** [12]: The importance of identifying regulatory requirements and best practice set out in Approved Codes of Practice (ACOPs) and other pieces of RGP for use in design risk reviews is described.
- **HI-2241089, Safety Management System Report** [32]: This report includes the Design Safety Management Plan which sets out foreseen arrangements that Holtec envision are necessary for future phases. Functions to implement the Holtec CDM Strategy [12], such as Trigger Questions based on RGP for use in design risk reviews are set out. Trigger questions are described in this section. A comprehensive set of UK health and safety RGP applicable to the SMR-300 is also set out in this report.

[REDACTED]

The Holtec CDM Strategy [12] sets out the need for identifying RGP for use in design risk reviews. The Design Safety Management Plan [32] sets out how a set of trigger questions will be used in future design risk reviews. Trigger questions will be produced based on RGP and will guide designers to mitigate risks SFAIRP. Also, a UK Prescriptive Legislation Guidance document will be produced used to support SMR-300 designers, based on prescriptive regulations, ACOPs and guidance. This will set out UK prescriptive health and safety limits. This is described in more detail in Section 12.5.3.1.5.2.

A comprehensive set of RGP is set out in Appendix D of the Safety Management System Report [32]. The codes and standards set out are considered RGP for the assessment of nuclear site health and safety in the UK because they all fall into one of the following categories:

- UK legislation published by HM Government.
- ACOPs published by the Health and Safety Executive (HSE).
- Health and safety guidance (HSG) published by HSE .
- Health and safety regulations (HSR) published by HSE.
- British Standards (BS) published by the UK's National Standards Body, the British Standards Institute (BSI).
- Technical Inspection Guides (TIGs) published by the ONR.

Section 12.4.1 below summarises the key RGP.

12.4.1 Codes and Standards

Goal-setting philosophy regulations and guidance applicable to UK Nuclear Site Health and Safety assessment are set out in Table 2. These regulations have been used to inform the production of SMR-300 GDA Tier 2 deliverables in readiness for the Detailed Design.

Table 2: Goal-Setting Nuclear Site Health and Safety Regulations, ACOPs and Guidance

Label	Title	Revision / Date
	Health and Safety at Work etc. Act [22]	1974
	Construction (Design and Management) (CDM 2015) Regulations [11]	2015
	Management of Health and Safety at Work Regulations [33]	1999
HSG 65	Managing for Health and Safety Health and Safety Guidance (HSG) [34]	2013
L153	Managing health and safety in construction: Construction (Design and Management) Regulations. Guidance on Regulations [35]	2015

In the application of the Nuclear Site Health and Safety GDA Step 2 deliverables, in activities such as design risk reviews, a suite of prescriptive UK health and safety legislation and guidance will be used in parallel. Application of these will ensure that UK RGP is considered in the development of the SMR-300 design. A list of prescriptive UK health and safety legislation and guidance is set out in Table 3. This list is not meant to be exhaustive.

Table 3: Prescriptive Nuclear Site Health and Safety Regulations, ACOPs and Guidance

Label	Title	Revision / Date
	Provision and Use of Work Equipment Regulations (PUWER) [36]	1998
	Workplace (Health, Safety and Welfare) Regulations [37]	1992
	The Control of Major Accident Hazards (COMAH) Regulations [21]	2015
	Lifting Operations and Lifting Equipment Regulations (LOLER) [38]	1998
	Work at Height Regulations [39]	2005
	Confined Spaces Regulations [40]	1997
	Control of Substances Hazardous to Health Regulations [41]	2002
	Manual Handling Operations Regulations [42]	1992
	The Control of Noise at Work Regulations [43]	2005
	The Control of Vibration at Work Regulations [44]	2005
	Dangerous Substances and Explosive Atmospheres Regulations (DSEAR) [5]	2002
	The Electricity at Work Regulations [45]	1989
	Pressure Systems Safety Regulations [46]	2000
BS 5975	Code of practice for temporary works [47] [48]	2024
HSG136	A guide to workplace transport safety [49]	2014
HSG141	Electrical safety on construction sites [50]	2023
HSG144	The safe use of vehicles on construction sites: A guide for clients, designers, contractors, managers and workers involved in construction transport [51]	2009
HSG150	Health and safety in construction [52]	2006
HSG33	Health and safety in roof work [53]	2020
HSG47	Avoiding danger from underground services [54]	2014
HSG85	Electricity at work: Safe working practices [55]	2013
HSR25	The Electricity at Work Regulations 1989: Guidance on Regulations [56]	2007
L101	Safe work in confined spaces: Confined Spaces Regulations. Approved Code of Practice [57]	2014
L111	The Control of Major Accident Hazards Regulations: Guidance on Regulations [58]	2015
L113	Safe use of lifting equipment: Lifting Operations and Lifting Equipment Regulations Approved Code of Practice and guidance [59]	2018
L121	Work with ionising radiation: Ionising Radiation Regulations Approved Code of Practice and guidance [60]	2018
L22	Safe use of work equipment: Provision and Use of Work Equipment Regulations Approved Code of Practice and guidance [61]	2018
L24	Workplace health, safety and welfare. Workplace (Health, Safety and Welfare) Regulations Approved Code of Practice and guidance [62]	2013
L5	Control of substances hazardous to health: The Control of Substances Hazardous to Health Regulations Approved Code of Practice and guidance [63]	2013
NS-INSP-GD-074	ONR Technical Inspection Guide: Construction (Design and Management) [64]	2024

12.4.2 Commitment

Holtec have raised a GDA commitment, **C_Mech_094**, related to incorporating Nuclear Site Health and Safety regulations, ACOPs and guidance (such as CDM 2015, LOLER and PUWER) into the design of mechanical handling and lifting equipment. Refer to PSR Part B Chapter 19 [9] for the commitment in full and the related CAE.

12.4.3 CAE Summary

In this sub-chapter the codes and standards that inform and complement the application of the Nuclear Site Health and Safety Step 2 deliverables have been introduced. This sub-chapter precedes Section 12.5, in which the Step 2 deliverables are explained in-depth.

The codes and standards set out are considered RGP for the assessment of nuclear site health and safety in the UK as they have been published by HM Government, or government bodies such as the HSE, the ONR and the BSI.

Holtec have raised a GDA commitment related to incorporating Nuclear Site Health and Safety regulations, ACOPs and guidance into the design of mechanical handling and lifting equipment.

This CAE Summary covers Claim 2.3.5.1 – A1. Claim 2.3.5.1 is decomposed into four more arguments, set out in Section 12.5 below. Therefore, this summary is completed in Section 12.5.7, CAE Summary.

12.5 NUCLEAR SITE HEALTH AND SAFETY ASSESSMENT

Claim 2.3.5.1: The generic Holtec SMR-300 is designed such that Nuclear Site Health and Safety risk is demonstrated to be reduced so far as is reasonably practicable using the hierarchy of risk control throughout the plant lifecycle.

Claim 2.3.5.1 has been further decomposed into five arguments. Four arguments to address the claim are set out in this section:

Argument 2.3.5.1 – A2: Holtec understand the requirements of CDM 2015 Designers and are prepared to implement these requirements throughout the plant lifecycle.

Argument 2.3.5.1 – A3: The SMR-300 design process will ensure the UK deployment of the SMR-300 meets UK statutory health and safety requirements

Argument 2.3.5.1 – A4: Holtec designers are competent to apply the requirements of CDM 2015 Designer duties.

Argument 2.3.5.1 – A5: Holtec are delivering a Nuclear Site Health and Safety Plan of Work that ensures the Claim and UK health and safety regulation compliance is achieved.

12.5.1 Background

Holtec are a nuclear technology designer and manufacturer. Throughout the lifecycle of the SMR-300, Holtec will undertake design activities, provide technical support and supply technology to the SMR-300 operator.

Holtec hold CDM 2015 Designer duties and successful discharge of these duties will satisfy the Claim. The main objective of the Nuclear Site Health and Safety Topic of the Preliminary Design Phase is to prepare in readiness for Detailed Design.

This has been delivered through production of the Holtec CDM Strategy [12] and Safety Management System Report [32], which includes a Design Safety Management Plan, in GDA Step 2.

Also, a COMAH Screening Report [65] has been produced by the Conventional Environmental Impact Assessment team. This document primarily supports PER Chapter 4 [20], but it also has an impact on Nuclear Site Health and Safety.

12.5.2 Holtec CDM Strategy

Argument 2.3.5.1 – A2: Holtec understand the requirements of CDM 2015 Designers and are prepared to implement these requirements throughout the plant lifecycle.

Evidence for Claim 2.3.5.1 – A2:

- **HI-2241088, Holtec CDM Strategy** [12]: This document presents a high-level strategy detailing how Holtec will discharge their CDM 2015 duties in the GDA and Design Phases, while planning a framework of how this will be achieved at later stages through to deconstruction. In essence, this strategy breaks down what CDM 2015 compliance means for Holtec and application of this strategy will ensure that Holtec and designers

in the supply chain comply with the legal requirements of CDM 2015. This is described in-depth in this section.

- **HI-2241089, Safety Management System Report** [32]: This report includes the Design Safety Management Plan. In this plan, Holtec's health and safety procedures that are common to all phases throughout the SMR-300's lifecycle are described. The plan also sets out how Holtec will implement the CDM Strategy [12] throughout all project phases. The Safety Management System Report [32] is described in-depth in Section 12.5.3.

12.5.2.1 CDM Duty Holders

Holtec are preparing and undertaking work for a future SMR-300 licensee and operator. As described in Section 12.5.1, Holtec will carry out design activities and provide technical support to the SMR-300 throughout its lifecycle. Holtec hold the *duties of designers*, Regulation 9 of CDM 2015 [11]. For CDM 2015 Regulation 9, see Appendix B.

Other appointments under CDM 2015 are the responsibility of the future licensee and operator. As the CDM 2015 Client, the licensee and operator will subsequently make the appointments of Principal Designer and Principal Contractor.

Holtec International are preparing and modifying the SMR-300 design outside of Great Britain. Therefore, the Client holds the responsibility of ensuring Designers' duties are complied with in-line with Regulation 10 of CDM 2015, *designs prepared or modified outside Great Britain* [11]. For CDM 2015 Regulation 10, see Appendix C. However, application of the Design Safety Management Plan [32] ensures that Holtec will comply with the *duties of designers* (Regulation 9) and subsequently Regulation 10 [11].

12.5.2.2 SMR-300 Lifecycle Phases

The main objective of the Preliminary Design Phase is to prepare in readiness for the Detailed Design. In Holtec's role carrying out design activities and providing technical support, the Detailed Design Phase is where the CDM 2015 Designer duties will be most pertinent and will encompass all elements of design. Following Detailed Design, Holtec will continue to carry out design activities and provide technical support to the SMR-300 at each phase throughout its lifecycle, therefore, Holtec will retain CDM 2015 Designer duties. The following phases are [6]:

- Construction and Manufacture.
- Commissioning.
- Operations and Plant EIMT.
- Decommissioning.

Design activities in these stages are set out in the Design Safety Management Plan, within the Safety Management System Report [32]. These include, but are not limited to:

- Addressing technical queries and design change requests.
- Contribution to risk reviews of construction, installation and commissioning processes, procedures and schedules.
- Supplying technical information on existing plant for EIMT and decommissioning, for example.

12.5.2.3 Objectives

The priority objective of the CDM Strategy in the Preliminary Design Phase has been to prepare in readiness for all following phases.

The priority objective of the CDM Strategy throughout all following phases is to ensure that Holtec discharge Designers' duties in a manner that ensures the reduction of conventional health and safety risks SFAIRP throughout the full lifecycle of the SMR-300.

12.5.2.4 Provisions

The steps that Holtec will take to ensure the above include, but are not limited to:

- Development and application of the Holtec integrated design methodology. The requirements for which are set out in the Design Safety Management Plan included in the Safety Management System Report [32].
- CDM Training of key Holtec personnel.
- Proceduralised communications with the Principal Designer and the supply chain (via the Principal Designer) to provide information on residual risks, pre-construction information and inputs for the Health and Safety File.
- Specification in contracts and purchase agreements to those in the supply chain with a design scope (UK and non-UK) to discharge Designers' duties and to provide information on residual risk in the form of a Design Risk Register. Instruction on how to comply with this will be set out in the specification.

Provisions are set out in full in the Holtec CDM Strategy [12].

12.5.2.5 Implementation

The Holtec CDM Strategy [12] will be implemented through the Design Safety Management Plan which is set out in the Safety Management System Report [32], outlined below.

12.5.3 Design Safety Management Plan

The purpose of the Safety Management System Report [32] is to set up the overall Holtec safety management system. As office safety is out-of-scope for GDA, the focus of the report is the Design Safety Management Plan [32].

The Design Safety Management Plan sets out how Holtec comply with CDM 2015 by setting out the health and safety arrangements specifically for detailed design, but also for design activities in subsequent phases. The Design Safety Management Plan details how compliance with RGP and UK regulation is addressed in these phases. These areas have been identified in the report and provisions to amend them have been set out. In subsequent phases, further revisions of the Design Safety Management Plan will be the procedure which ensures the SMR-300 is safe by design.

In addition to phase-specific arrangements, the Design Safety Management Plan includes elements of health and safety that are common and applicable to all lifecycle phases. The Report [32] describes Holtec's common elements, including:

- Behavioural Safety

- Safety Leadership
- Application of RGP
- Competency Management and Assurance
- OPEX and Learning from Experience (LfE)
- Cooperation and Coordination
- Monitoring and Review (Audits)

Phase-specific arrangements are described below.

12.5.3.1 Preliminary Design Phase

The Holtec Nuclear Site Health and Safety responsibilities follow two common themes: GDA responsibilities and preparation for detailed design.

12.5.3.1.1 GDA Responsibilities

The current Nuclear Site Health and Safety responsibilities of Holtec are:

- Liaising with the Regulators on Nuclear Site Health and Safety issues including Regulatory Queries, Regulatory Issues, Regulatory Observations;
- Coordinating and cooperating within Holtec and across all GDA topics on Nuclear Site Health and Safety issues;
- Demonstrating positive Health and Safety behaviours and leadership;
- Developing competence.

12.5.3.1.2 Preparation for the Detailed Design

The Holtec CDM Strategy indicates that the Preliminary Design Phase is a preparatory phase to Detailed Design and that the design is defined in a Design Reference Point for the purposes of GDA assessment.

Section 5.1 of the Holtec CDM Strategy [12] sets out a list of actions that Holtec envision must be achieved in readiness for Detailed Design. The steps needed to implement these actions in the Preliminary Design Phase in preparation for Detailed Design are set out in Section 4.2.3 of the Safety Management System Report [32]. Holtec acknowledge these actions are live, and there may be additions, deletions and merging of actions subject to requirements.

These follow three themes:

1. Identify requirements related to CDM 2015 for the Detailed Design Phase;
2. Develop and implement the Design Safety Management Plan to ensure discharge of Designers' duties in the Detailed Design Phase and subsequent phases, and;
3. Develop designers' competency in Holtec through training on CDM 2015 focusing on Designers' duties.

12.5.3.1.2.1 Commitment

Holtec have raised a GDA commitment related to this workstream:

C_NSHS_116: Organisational and procedural arrangements are required for the UK deployment of an SMR-300 to demonstrate compliance with CDM 2015 Designer duties during the Detailed Design phase and subsequent phases. A Commitment is raised to ensure compliance with CDM 2015 Designers' Duties throughout the UK SMR-300 project lifecycle. Target for resolution - Commencement of the UK Detailed Design Phase.

The following sections describe Arguments and Evidence of how this commitment is being delivered:

- 12.5.3.1.3 - Design Methodology;
- 12.5.3.1.4 - CDM 2015 Training;
- 12.5.3.1.5 - Claim – Risk – Mitigation – Plan of Work

12.5.3.1.3 Design Methodology

Argument 2.3.5.1 - A3: The SMR-300 design process will ensure the UK deployment of the SMR-300 meets UK statutory health and safety requirements.

Evidence for Claim 2.3.5.1 – A3:

- **HI-2241088, Holtec CDM Strategy** [12]: The need for an agreed Holtec design methodology in readiness for the Detailed Design Phase is set out in the CDM Strategy. This will ensure that the SMR-300 complies with CDM 2015 [11] and other UK health and safety legislation.
- **HI-2241089, Safety Management System Report** [32]: This report includes the Design Safety Management Plan. The design methodology that Holtec are producing will make up a large portion of this plan in future phases.
- **HI-2250232, UK GDA [DC10] Design Challenge - Conventional Health and Safety** [66]: This document highlights opportunities for the SMR-300 design process to be further aligned to meet UK statutory health and safety requirements, such as CDM 2015.

Consistent with the themes presented in Section 12.5.3.1.2, the SMR-300 design methodology will ensure the UK deployment of the SMR-300 meets UK statutory health and safety requirements. UK statutory health and safety requirements and how these are or should be met by the SMR-300 design process are presented in the Design Adaptation Committee (DAC) Paper [66]. For details on the DAC process, see Holtec SMR-300 Design Management, which is described in PSR Chapter A4 [6] [67].

The SMR-300 design methodology is presented in the Design Control Procedure [68] which will be fully implemented, for UK Health and Safety legislative requirements, in readiness for the Detailed Design Phase as per **C_NSHS_116**. This will contribute to the Design Safety Management Plan in the Detailed Design Phase and subsequent phases. The SMR-300 Design Control [68] procedure is described in PSR Part A Chapter 4 [6]. The procedure establishes key design arrangements and framework that will deliver a design methodology that will ensure the UK deployment of the SMR-300 meets UK statutory health and safety

requirements. Implementation and delivery of the final design methodology[1] is still to be planned. Holtec have made commitments in PSR Chapter A4 to fully implement the SMR Design Control procedure [68], including Design Integration Reviews under **C_MSQA_107** which will be a key mechanism to demonstrating conventional health and safety risks have been minimised. A Commitment is also made to produce a UK Design Manual and a UK System Engineering Management Plan to support management of future UK SMR-300 design development, see **C_MSQA_108.** The UK documents will fully support requirements discussed in this Chapter.

Holtec will continue to interact with the SMR-300 design methodology through the formal process of raising further DAC Papers [67], as described in PSR Part A Chapter 4.

Holtec have also run a pilot design risk review to gain experience and LfE on the most efficient means of communicating the design risk review process to all SMR-300 designers. This will be used when influencing the SMR-300 design methodology. The pilot focussed on the lifecycle of the Containment Enclosure Structure (CES) Concrete Strengthened Steel Modules (CSSMs) as an example. The pilot included a multidisciplinary team and looked at the CSSMs from transport from the manufacturing facility to a site in the Construction Phase, through to the Decommissioning Phase.

12.5.3.1.4 CDM 2015 Training

Argument 2.3.5.1 – A4:. Holtec designers are competent to apply the requirements of CDM 2015 Designer duties.

Evidence for Claim 2.3.5.1 – A4:

- **HI-2241088, Holtec CDM Strategy** [12]: The requirement to deliver CDM 2015 Training to key Holtec personnel throughout the lifecycle of plant is set out in the CDM Strategy.
- **HI-2241089, Safety Management System Report** [32]: The status of the CDM Training, at the time when the report was published, is set out in this report. A slide pack and presentation available to all designers and an interactive package with tests of understanding and feedback are being developed. Also, to support the training programmes, a CDM 2015 Guidance Document is being developed.

The theme ‘Develop designers’ competency in Holtec through training on CDM 2015 focusing on Designers’ duties’ identified in Section 12.5.3.1.2 is being addressed in the development of CDM 2015 training and guidance for designers, which is being delivered in parallel with the SMR-300 design methodology. This will ensure Holtec designers are competent to deliver the UK statutory health and safety requirements through the design methodology.

CDM 2015 training and guidance will be delivered throughout the lifecycle of the SMR-300 to Holtec designers. Holtec designers must be competent [69] to implement requirements of Designers’ duties. The training and guidance is being delivered through a series of training

[1] Note that the term ‘*design methodology*’ refers to the suite of processes, procedures and guidance that influence the design process.

sessions and production of guidance for designers which Holtec are currently producing in readiness for the Detailed Design Phase.

A programme of CDM Awareness Training has commenced, the first three sessions have been delivered. This took the form of a slideshow and presentation. Interactive CDM 2015 Designers' Duties Training is in production to be delivered to key Holtec SMR-300 designers. The guidance will summarise the key CDM 2015 responsibilities of SMR-300 designers. This will be issued to SMR-300 designers and available to all Holtec staff.

As the SMR-300 project grows, it is envisioned that CDM 2015 training will make up part of an onboarding training pack when joining Holtec and/or the SMR-300 project. This will be followed up with ongoing periodic training. Further details on training and competency are provided in PSR Chapter A4 [6].

12.5.3.1.5 Claim – Risk – Mitigation – Plan of Work

[REDACTED]

12.5.3.1.5.1 Claim – Risk

[REDACTED]

12.5.3.1.5.2 Risk – Mitigation

[REDACTED]

12.5.3.1.5.3 Mitigation – Plan of Work

[REDACTED]

12.5.3.2 Detailed Design Phase

[REDACTED]

12.5.3.3 Future Phases

Holtec are committed to deliver CDM 2015 Designers' Duties throughout the SMR-300's lifecycle. The design activities and technical support that Holtec provide in subsequent phases to the Detailed Design Phase will follow the same UK best-practice and statutory requirements. Arrangements to ensure compliance will be set out in the Design Safety Management Plan. This plan, along with other project management system arrangements, will be reviewed and revised as the project develops and matures. For example, in the Commissioning Phase, the plan will address issues, requiring design input, arising out of the implementation of the Test and Commissioning Schedule (or similar).

For the purposes of the PSR, the Design Safety Management Plan is described in the respective section of the Safety Management System Report [32] covering the following phases;

- Construction and Manufacture Phase – 4.4
- Commissioning Phase – 4.5
- Operations and Plant EIMT Phase – 4.6

- Decommissioning Phase – 4.7

12.5.4 COMAH Screening Report

The early-stage COMAH [21] screening assessment has found that the SMR-300 site has the potential to be an upper tier COMAH site due to hydrazine inventories.

Holtec's Nuclear Site Health and Safety influence on major accident hazards, such as hydrazine inventories, extends as far as ensuring the design of the SMR-300 eliminates hazards where possible and otherwise controls the related risk. Application of the CDM Strategy, in conjunction with the COMAH Regulations [21], will ensure that considerations such as storage locations, the plant's layout and vicinity to ignition sources reduce COMAH related risks SFAIRP.

It will be the SMR-300 operator's responsibility to ensure that the Duties of Operators (Regulation 5 of COMAH) [21] are applied.

Future work, beyond step 2, will identify both the inventory and concentrations of COMAH chemicals used by the SMR-300. These chemicals shall be compared with the corresponding COMAH qualifying thresholds and classification of site to determine whether the SMR-300 is likely to be a COMAH establishment. If the SMR-300 site is a COMAH establishment, all relevant COMAH Regulations [21] will be implemented.

See the COMAH Screening Assessment [65] for the full methodology and findings.

12.5.5 Layout

The SMR-300 site layout is driven by three main design philosophies; safety, performance and constructability, as set out in the SMR-300 Top Level Plant Design Requirements document [70]. Subsequently, there are 191 top level plant design requirements, driven by plant objectives, the Electric Power Research Institute's Utility Requirements Document [71] and other sources such as sound engineering and operating principles. Assurance of personnel safety is paramount in SMR-300 design and this is ensured through the top level plant design requirements. For example:

- The design shall provide adequate access space for installation, construction fit up, and commissioning of plant SSCs.
- The design shall provide adequate access space for maintenance, testing, operation, and component removal or replacement necessary to achieve plant design life.
- The plant shall be designed so that the environment under which the maintenance and testing of equipment must be performed provides satisfactory working conditions, including temperature, dose, ventilation, and illumination.

The constructability design philosophy is discussed further in Section 12.5.6 below.

12.5.6 Prefabrication, Preassembly, and Modularisation

The SMR-300 adopts prefabrication, preassembly, and modularisation as construction techniques. This is driven by the constructability design philosophy and specific plant requirements, as set out in the SMR-300 Top Level Plant Design Requirements [70]. This moves on-site construction to manufacturing and fabrication workshops where the

environment is controlled and this will also vastly reduce the on-site programme, thereby reducing the risk to construction workers. Enveloped within the constructability philosophy is consideration for the full design life of the plant and the future decommissioning and dismantling activities. Prefabrication, preassembly, and modularisation will be used to the maximum extent practicable throughout the full SMR-300 plant [70]. On this scale in the UK nuclear industry, this is considered novel.

The CES is to be constructed out of CSSMs, which are steel-concrete panels with internal steel diaphragms that will be fabricated in workshops and transported to site. On site, they will be assembled, welded together and filled with concrete to form the CES. During GDA Step 2, Holtec have produced an evaluation report of the CES design concept [72]. This sets out conventional health and safety benefits and considerations of the CES design, including modularisation during construction, operation, EIMT and decommissioning. The CSSMs have engineered health and safety features considered at their concept stage. These include [73]:

[REDACTED]

This design is still under development and will be further optimised in the Detailed Design Phase. Modularisation of the CES is also discussed in PSR Part B Chapter 20 [10] and PSR Part B Chapter 25 [13].

12.5.7 CAE Summary

Holtec will ensure that conventional health and safety risk related to the SMR-300's lifecycle is reduced SFAIRP through application of the CDM Strategy which was produced in GDA Step 2.

The Safety Management System Report [32] includes the Design Safety Management Plan for the current phase which sets out foreseen arrangements that Holtec envision are necessary for future phases. Implementing this plan is how Holtec will apply the CDM Strategy in future phases. During GDA Step 2, the main objective of the Design Safety Management Plan is to prepare in readiness for the Detailed Design Phase. The report also sets out how Holtec foresee the Nuclear Site Health and Safety requirements evolving throughout the SMR-300's lifecycle.

Holtec hold CDM 2015 Designer duties. CDM 2015 training for key Holtec personnel will ensure that designers are competent to discharge their duties.

Holtec are aware of the actions that must be completed in readiness for the Detailed Design Phase. These actions have been grouped into mitigations to risks associated with not achieving Claim 2.3.5.1 and UK health and safety legislative compliance. The Nuclear Site Health and Safety team have mapped how the Claim links to the actions through a hierarchy of risks and have built a Plan of Work to assure the golden thread of actions is captured and delivered.

Holtec have raised a GDA commitment to ensure compliance with CDM 2015 Designers' Duties throughout the UK SMR-300 project lifecycle.

This CAE Summary covers Claim 2.3.5.1 – A2 to A5. Claim 2.3.5.1 is decomposed into one more argument, set out in Section 12.4. The CAE Summary for Claim 2.3.5.1 – A5 is set out in Section 12.4.3.

12.6 CONVENTIONAL FIRE SAFETY CODES AND STANDARDS / METHODOLOGIES

12.6.1 Codes and Standards / Methodologies / Integration Approach

Elements to afford plant workers and fire intervention personnel with an acceptable level of protection from the effects of fire are being included in the SMR-300 design based on the recommendations in NFPA standards 804 [27] and 101 [28].

NFPA 804 [27] has been developed specifically for nuclear power plants and was first released in 1995. It provides fire safety recommendations for a range of objectives such as: safe shutdown and minimising release of radioactive material. Whilst the standard provides some recommendations directly relating to life safety, it mostly references NFPA 101 [28] for life safety guidance. NFPA 101 [28] is one of the dominant standards in the NFPA suite providing guidance for the protection of life against the effects of fire.

As per ONR guidance [26], it is assumed that alignment with RGP satisfies the requirement that conventional fire safety risks have been reduced to an ALARP basis and only the differences between the design and RGP need to be assessed in the frame of the ALARP methodology.

It is argued that given the specific features and constraints in the technical buildings on a nuclear power plant site, the adoption of NFPA standards such as NFPA 804 [27] as the basis of design for conventional fire safety is acceptable in the UK for the generic SMR-300 buildings and across the wider site.

It is considered that the NFPA standards are acceptable as RGP for the generic SMR-300 buildings and the site given their maturity and depth and their adoption / application globally to ensure that an acceptable level of fire safety is provided in buildings and structures. They provide recommendations for a range of building types and generally provide a level of detail beyond that offered by other fire safety codes and standards. Furthermore, unlike UK codes and standards such as Approved Document B [29] and BS 9999 [30], NFPA offers recommendations specifically for nuclear power plant sites. This, already strong basis of design, is further enhanced by the assessment of the generic SMR-300 buildings and structures in the frame of the UK legislative requirement that conventional fire safety risks are reduced to ALARP, in effect providing a level of defence in depth.

The conventional fire safety strategies will also consider UK specific guidance in standards such as BS 9999 [30] in the development of buildings and structures to ensure that the means for firefighting access and firefighting provisions are incorporated in line with general UK firefighting practices, as far as practicable.

12.6.2 CAE Summary

The adoption of NFPA fire safety standards as RGP is argued to be an acceptable basis of conventional fire safety design for the generic SMR-300 buildings, structures, and site to demonstrate adequate means of escape and firefighting access provisions. The design has been assessed against the proposed RGP in line with the scope of the GDA process. Differences between RGP provisions and the design have been identified and design adaptation areas proposed and endorsed for implementation by the DAC to mitigate or reduce

the risks. Where differences are expected to remain following design development, these have been identified and next steps to achieving ALARP noted as part of the High-Level Conventional Fire Strategy Document [74].

This forms Claim 2.3.5.2 – A1 on RGP, with details elaborated in Section 12.7.1. Claim 2.3.5.2 is decomposed into five arguments, as set out in Section 12.7 below. Therefore, the CAE Summary is completed in Section 12.7.6 CAE Summary.

12.7 CONVENTIONAL FIRE SAFETY ASSESSMENT

Claim 2.3.5.2: The generic Holtec SMR-300 is designed so that occupants are able to evacuate their building safely, without assistance; and that the fire and rescue service can undertake firefighting activities in the event of a fire.

Claim 2.3.5.2 relates to buildings incorporating provisions to afford plant workers with safe means of egress in the event of a fire and similarly allow firefighters to undertake firefighting activities. The assessments related to Claim 2.3.5.2 during GDA are limited to the Nuclear Island buildings and structures within the GDA scope, these being CES, Containment Structure (CS), Intermediate Building (IB), and Reactor Auxiliary Building (RAB), and additionally limited to aspects of their design that might require structural changes to resolve, e.g., extent of protected access and escape routes.

Due to the differences between the CES, CS, IB, and RAB and their provisions for means of escape and firefighting, the arguments for Claim 2.3.5.2 are made separately for each building in the sub-sections 12.7.1 to 12.7.5 (effectively decomposed into five arguments to address the claim).

Whilst RGP for conventional fire safety is proposed and planned to be applicable NFPA standards, as adopted for the SMR-300, the assessment of firefighting means in the High-Level Conventional Fire Strategy Document [74] and of claim 2.3.5.2 in this chapter is cognisant that the design of buildings and structures will also need to be mindful of UK specific firefighting practices and the risk firefighting personnel are willing to accept whilst undertaking firefighting activities.

12.7.1 Relevant Good Practice

Argument 2.3.5.2 – A1: Differences (constituting risks) between the proposed design and RGP have been identified by assessing the SMR-300 against UK specific RGP (i.e., BS 9999 [30]). The design, and identified risks, were also evaluated against the proposed US-based / generic SMR-300 RGP (i.e., NFPA 804 [27] and NFPA 101 [28]).

In addition to CAE related to conventional fire in this PSR chapter, assessment of the design proposals for the CES, CS, IB, and RAB against UK-specific RGP in BS 9999 [30] was carried out. This assessment was undertaken prior to NFPA standards being proposed as RGP for the generic SMR-300 project and is contained in the Step 2 deliverable, the Risk Identification Report for UK Conventional Fire Safety Design [75].

NFPA 804 [27] and NFPA 101 [28] were proposed as RGP in place of BS 9999 [30] in the period between the development of the Risk Identification Report for UK Conventional Fire Safety Design [75] and High-Level Conventional Fire Strategy Document [74] and whilst [75] was not revised due to the change to the basis of RGP, the main differences between the design proposals for the CES, CS, IB, and RAB and NFPA 804 [27] and NFPA 101 [28] recommendations were assessed and included in the High-Level Conventional Fire Strategy Document [74].

Whilst not the focus of the report, the High-Level Conventional Fire Strategy Document [74] also includes a comparison of BS 9999 [30] recommendations versus NFPA 804 [27] and

NFPA 101 [28] at least in relation to the differences raised in the Risk Identification Report for UK Conventional Fire Safety Design [75].

It is argued that the design has been assessed against both UK and US based RGP with key differences, under the scope of GDA, identified. Refer to Table 13 in the High-Level Conventional Fire Strategy Document [74] for further details. The assessment is considered foundational to achieving Claim 2.3.5.2 by identifying key differences, under the GDA, which in turn form the basis of design development and further assessment aiming to demonstrate that conventional fire safety risks are ALARP.

12.7.2 Containment Enclosure Structure

[REDACTED]

12.7.3 Containment Structure

[REDACTED]

12.7.4 Intermediate Building

[REDACTED]

12.7.5 Reactor Auxiliary Building

[REDACTED]

12.7.6 CAE Summary

The generic SMR-300 DRP proposals for the CES, CS, IB, and RAB have been reviewed, against RGP, in the frame of conventional fire safety issues that risk structural changes being needed to resolve and a number of improvements to the CS and RAB endorsed in a DAC. With the endorsements included it is considered that Claim 2.3.5.2 has been sufficiently demonstrated to the maturity level expected for a PSR.

12.8 CHAPTER SUMMARY AND CONTRIBUTION TO ALARP

This sub-chapter provides an overall summary and conclusion of the Nuclear Site Health and Safety and Conventional Fire Safety Chapters and how Chapter B12 contributes to the overall demonstration of ALARP for the generic SMR-300. Chapter A5 [76] 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 RGP.
    - Evaluation of Risk and Demonstration Against Risk Targets (where applicable).
    - Options Considered to Reduce Risk.
- GDA Commitments
- Conclusion.

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

12.8.1 Technical Summary

PSR Chapter B12 aims to demonstrate the following level 3 claim to a maturity appropriate for a PSR:

Claim 2.3.5: Nuclear site health and safety and conventional fire safety are managed to ensure that the conventional health and safety risks, and fire safety risks to workers and the public are reduced so far as is reasonably practicable.

12.8.1.1 Nuclear Site Health and Safety

In this revision of this chapter, it has been shown that Holtec have set up strategies and procedures to control and manage nuclear site health and safety risk through design in line with UK Regulation and RGP. This ensures that risk will be reduced SFAIRP by Holtec and other designers in the supply chain throughout the SMR-300's lifecycle. Building on the progress made to date with the CDM training, the design methodology and other actions set out in GDA deliverables, will ensure that Holtec are ready to discharge their duties as a CDM 2015 Designer at the closing of the Preliminary Design Phase.

12.8.1.2 Conventional Fire Safety

The generic SMR-300 DRP proposals for the CES, CS, IB, and RAB have been reviewed, against RGP, in the frame of conventional fire safety issues that risk structural changes being needed to resolve, and a number of improvements to the CS and RAB were endorsed in a DAC. With the endorsements related to the RAB included it should be possible to demonstrate post GDA that provisions for escape and firefighting are ALARP, at least without further significant structural changes being needed. Likewise, in the IB and in the CES it is considered likely that ALARP can be demonstrated without significant structural changes being needed.

The addition of two open spiral stairs in the CS was endorsed in a DAC and confirmed as a prospective design change [77]. The addition of the open spiral stairs improves arrangements for vertical travel within the space, but further assessment will be needed post GDA to demonstrate that conventional fire safety risks are ALARP. It should be possible to avoid further significant structural changes if assumptions made in the High-Level Conventional Fire Strategy Document [74] regarding occupancy, fire load, and fire risk within the CS space prove valid.

Refer to High-Level Conventional Fire Strategy Document [74] for further details relating to ALARP and conventional fire safety in the CES, CS, IB, and in the RAB.

12.8.2 ALARP Summary

12.8.2.1 Demonstration of RGP

12.8.2.1.1 Nuclear Site Health and Safety

The key piece of construction health and safety legislation in the UK is the CDM 2015 Regulations [11]. This sets out a goal-setting philosophy to controlling conventional health and safety risks SFAIRP. SFAIRP is a legal requirement that, in laymen's terms, requires designers to make their designs as safe as possible without resorting to excessive resource. In other words, that risk is reduced to a level that is ALARP. The ALARP terminology is used in the UK nuclear industry and is synonymous with SFAIRP.

During GDA Step 2, Holtec have produced a CDM Strategy [12] and a Design Safety Management Plan [32] which set out how Holtec will comply with these regulations throughout the SMR-300's lifecycle. This includes cascading CDM 2015 responsibilities of Designers throughout Holtec and other designers in the supply chain.

CDM 2015 requires designers to carry out risk control processes such as designers' risk assessments. These will be carried out addressing a suite of prescriptive UK health and safety RGP legislation and guidance. These cover specific activities such as working at height or in confined spaces. A non-exhaustive list of prescriptive health and safety RGP can be found in Table 3. The codes and standards set out are considered RGP for the assessment of nuclear site health and safety in the UK as they have been published by HM Government, or government bodies such as the HSE, the ONR and the BSI.

12.8.2.1.2 Conventional Fire Safety

Conventional fire safety measures have been incorporated into the SMR-300 design based on the recommendations of NFPA standards, primarily NFPA 804 [27] and NFPA 101 [28].

The generic SMR-300 design was assessed against the main requirements of UK specific RGP during GDA and major differences between the design and UK RGP, specifically BS 9999 [30] highlighted. Refer to the Risk Identification Report for UK Conventional Fire Safety Design [75] for further details.

The generic SMR-300 was assessed against the main conventional fire safety recommendations from NFPA 804 [27] and NFPA 101 [28], and whilst a direct comparison of recommendations in these NFPA standards versus BS 9999 [30] was not made, it was generally observed that their approaches to conventional fire safety are similar.

NFPA 804 [27], first released in 1995, has been specifically developed for nuclear electric generating plants. Whilst developed principally for the US marketplace, NFPA 101 [28] is commonly referenced for the design of buildings worldwide, is almost 600 pages, and is a detailed fire safety code.

Based on the regular adoption of NFPA 101 [28] internationally and the similarities between UK specific RGP such as BS 9999 [30] and approaches in NFPA 101 [28], it is considered that NFPA 804 [27] and NFPA 101 [28] can be adopted as RGP for the generic SMR-300 (to inform the fire safety strategies for the buildings across the site, and the site itself).

Whilst NFPA 804 [27] and NFPA 101 [28] are proposed as RGP, it is recognised that elements of the strategy relating to firefighting access and operations by UK fire and rescue service personnel will need to consider UK specific approaches to firefighting, e.g., recommendations in BS 9999 [30].

Refer to Section 12.6.1 for further arguments underpinning the adoption of NFPA 804 [27] and 101 [27] as RGP for the generic SMR-300.

12.8.2.2 Evaluation of Risk and Demonstration Against Risk Targets (where applicable)

The numerical targets against which the demonstration of ALARP is considered can be found in PSR Part A Chapter 2 [3].

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

12.8.2.2.1 Nuclear Site Health and Safety

Nuclear Site Health and Safety contributes to the demonstration of ALARP by ensuring that risks identified during design activities are either eliminated or mitigated SFAIRP, thereby contributing to achieving Targets 5, 7 and 9.

Nuclear Site Health and Safety is assessed qualitatively and relies on the competency of individuals and organisations to judge the level of risk that is ALARP. For the SMR-300 in the UK, this will be ensured through an SMR-300 design methodology and CDM Training, set out in 12.5.3.1.3 and 12.5.3.1.4 respectively.

12.8.2.2.2 Conventional Fire Safety

The numerical targets, stemming from ONR safety assessment principles relate to dose rates and fatalities from ionising radiation, and are not considered directly applicable to conventional fire safety studies although it is recognised that conventional fire safety contributes to the overall safety of the plant.

12.8.2.3 Options Considered to Reduce Risk

The process for the assessment of risk reduction options is presented in Holtec SMR-300 Design Management [67].

12.8.2.3.1 Nuclear Site Health and Safety

Nuclear Site Health and Safety presented a DAC paper [66] in GDA Step 2. This proposed improvements to the SMR-300 design procedure to strengthen consideration of both US and UK legislative health and safety requirements. This was received positively, and the DAC actioned Nuclear Site Health and Safety team to work with the Holtec International SMR-300 designers to establish and plan implementation to ensure that UK legislative requirements could be integrated into the SMR-300 design process. This work is ongoing and covered the status of design management addressed in PSR Chapter A4 [6].

Holtec have made commitments in PSR Chapter A4 to fully implement the SMR Design Control procedure [68], including Design Integration Reviews under **C_MSQA_107**. A Commitment is also made to produce a UK Design Manual and a UK System Engineering Management Plan to support management of future UK SMR-300 design development. See **C_MSQA_108.**

12.8.2.3.2 Conventional Fire Safety

Conventional fire safety also raised a successful DAC paper [78] during GDA Step 2 resulting in structural / layout changes being endorsed in the RAB and also in the CS to improve means for access and escape. Refer to Section 12.8.3 and the High-Level Conventional Fire Safety Report [74] for further details.

12.8.3 GDA Commitments

GDA Commitments which relate to this Chapter have been formally captured in the Commitments, Assumptions and Requirements process [4]. Further details of this process are provided in Part A Chapter 4 [6]. Nuclear Site Health and Safety have identified one commitment:

- **C_NSHS_116:** Organisational and procedural arrangements are required for the UK deployment of an SMR-300 to demonstrate compliance with CDM 2015 Designer duties during the Detailed Design phase and subsequent phases. A Commitment is raised to ensure compliance with CDM 2015 Designers' Duties throughout the UK SMR-300 project lifecycle. Target for resolution - Commencement of the UK Detailed Design Phase.

Chapter B12 Conventional fire safety has identified the following commitments:

- **C_Fire_121:** Design Challenge paper HI-2241519 relates to means of escape and firefighting access in the CS and identifies a number of recommendations against UK RGP. A Commitment is raised to progress this Design Challenge through the Design Management process (HPP-3295-0017-R1.0) to completion. Target for Resolution – Issue of UK Pre-Construction SSEC.
- **C_Fire_122:** Design Challenge Paper HI-2241519 relates to means of escape and firefighting access in the RAB and identifies a number of recommendations against UK RGP. A Commitment is raised to progress this Design Challenge through the Design Management process (HPP-3295-0017-R1.0) to completion. Target for Resolution – Issue of UK Pre-Construction SSEC.

12.8.4 Conclusion

12.8.4.1 Nuclear Site Health and Safety

This chapter highlights key UK health and safety requirements and legislation related to construction and design. The Nuclear Site Health and Safety claim, that forms the basis of the safety case, is described. Arguments that support the claim have been set out. Evidence has been provided to substantiate the claim and arguments to a fundamental level, appropriate to the current maturity of the SMR-300 project.

To align the design process of the SMR-300 with UK requirements and best practice, Holtec have produced a CDM Strategy [12] and Design Safety Management Plan, within the Safety Management System Report [32]. These set out Holtec's current and planned processes to deal with Nuclear Site Health and Safety through the SMR-300's lifecycle.

Holtec are delivering CDM 2015 training to Holtec staff, this training will continue throughout the delivery of the SMR-300. A Nuclear Site Health and Safety Plan of Work has been developed, which includes the current foreseeable actions required to ensure compliance with UK health and safety legislation and standards, and to reduce any associated risks. Some of these actions have been completed in PSR timescales, and the rest will be completed in readiness for the Detailed Design Phase.

Holtec have made commitments in PSR Chapter A4 to fully implement the SMR Design Control procedure [68], including Design Integration Reviews under **C_MSQA_107**. A Commitment is also made to produce a UK Design Manual and a UK System Engineering Management Plan to support management of future UK SMR-300 design development. See **C_MSQA_108.**

Holtec have raised a GDA commitment **C_NSHS_116** to ensure compliance with CDM 2015 Designers' Duties throughout the UK SMR-300 project lifecycle.

It is therefore, judged that Nuclear Site Health and Safety is demonstrated to align with the ALARP principle throughout the lifecycle of the SMR-300, subject to planned provisions set out in GDA Step 2 deliverables and this PSR chapter.

12.8.4.2 Conventional Fire Safety

This chapter highlights the key legislation and proposed RGP applicable to conventional fire safety. The conventional fire safety claim, that forms the basis of the safety case is described. Arguments that support the claim have been set out and evidence has been provided to substantiate the claim and arguments, to a level appropriate to the current stage of the generic SMR-300 in its lifecycle.

This chapter also summarises the assessments made in the High-Level Conventional Fire Strategy Report [74], changes to improve conventional fire safety endorsed in DAC [77], and the likely ability to demonstrate ALARP post GDA.

12.9 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-2240333, Holtec SMR GDA PSR Part A Chapter 2 General Design Aspects and Site Characteristics,” Revision 1, July 2025.

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

[5] HM Government, “Dangerous Substances and Explosive Atmospheres Regulations 2002,” 2002.

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

[7] Holtec Britain, “HI-2240340, Holtec SMR GDA PSR Part B Chapter 9 Conduct of Operations,” Revision 1, July 2025.

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

[9] Holtec Britain, “HI-2240356, Holtec SMR GDA PSR Part B Chapter 19 Mechanical Engineering,” Revision 1, July 2025.

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

[11] HM Government, “The Construction (Design and Management) Regulations 2015,” 2015.

[12] Holtec Britain, “HI-2241088, Holtec Britain CDM Strategy, Revision 0,” 2024.

[13] Holtec Britain, “HI-2240345, Holtec SMR GDA PSR Part B Chapter 25 Construction and Commissioning,” Revision 1, July 2025.

[14] Holtec Britain, “HI-2240355, Holtec SMR GDA PSR Part B Chapter 26 Decommissioning Approach,” Revision 1, July 2025.

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

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

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

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

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

[20] Holtec Britain, "HI-2240363, Holtec SMR GDA PER Chapter 4 Conventional Impact Assessment," Revision 1, 2025.

[21] HM Government, "Control of Major Accident Hazards (COMAH) Regulations 2015," 2015.

[22] HM Government, Health and Safety at Work etc. Act 1974, 1974.

[23] HM Government, "The Work at Height Regulations 2005," 2005.

[24] International Organization for Standardization, "ISO 45001:2018, Occupational health and safety management systems — Requirements with guidance for use, Edition 1," 2018.

[25] Holtec International, "Corporate Manual CD-029 Environmental, Health and Safety Management System Manual, Revision 3," 2021.

[26] Office for Nuclear Regulation, "ONR-GDA-GD-007, New Nuclear Power Plants: Generic Design Assessment Technical Guidance," Revision 0, May 2019.

[27] National Fire Protection Association, "NFPA 804 Standard for Fire Protection for Advanced Light Water Reactor Electric Generating Plants," 2020.

[28] National Fire Protection Association, "NFPA 101 Life Safety Code," 2021.

[29] Approved Document B (fire safety) volume 2: Buildings other than dwellings, 2019 edition incorporating 2020 and 2022 amendments, HM Government, 2019.

[30] British Standards Institute, BS 9999:2017 Fire Safety in the design, management and use of buildings - Code of Practice, 2017.

[31] UK Government, “No. 2214, Building and Buildings England and Wales The Building Regulations 2010 (with amendments),” 2010.

[32] Holtec Britain, “HI-2241089, SMR-300 GDA Holtec Nuclear Site Health and Safety Management System Report, Revision 0,” 2025.

[33] HM Government, “The Management of Health and Safety at Work Regulations 1999,” 1999.

[34] Health and Safety Executive, “HSG65, Managing for health and safety, 3rd Edition,” 2013.

[35] Health and Safety Executive, “L153, Construction (Design and Management) Regulations 2015. Guidance on Regulations,” 2015.

[36] HM Government, “The Provision and Use of Work Equipment Regulations 1998,” 1998.

[37] HM Government, “Workplace (Health, Safety and Welfare) Regulations 1992,” 1992.

[38] HM Government, “Lifting Operations and Lifting Equipment Regulations 1998,” 1998.

[39] HM Government, “Work at Height Regulations 2005,” 2005.

[40] HM Government, “Confined Spaces Regulations 1997,” 1997.

[41] HM Government, “Control of Substances Hazardous to Health Regulations 2002,” 2002.

[42] HM Government, “Manual Handling Operations Regulations 1992,” 1992.

[43] HM Government, “The Control of Noise at Work Regulations 2005,” 2005.

[44] HM Government, “The Control of Vibration at Work Regulations 2005,” 2005.

[45] HM Government, “The Electricity at Work Regulations 1989,” 1989.

[46] HM Government, “Pressure Systems Safety Regulations 2000,” 2000.

[47] British Standards Institute, “BS 5975-1:2024 Temporary works. Management procedures for the control of temporary works. Code of practice,” 2024.

[48] British Standards Institute, “BS 5975-2:2024 Temporary works. Falsework: Design and implementation. Code of practice,” 2024.

[49] Health and Safety Executive, “HSG136, A guide to workplace transport safety, 3rd Edition,” 2014.

[50] Health and Safety Executive, “Electrical safety on construction sites, 2nd Edition,” 2023.

[51] Health and Safety Executive, “HSG144, The safe use of vehicles on construction sites, 2nd edition,” 2009.

[52] Health and Safety Executive, “HSG150 Health and safety in construction, 3rd Edition,” 2006.

[53] Health and Safety Executive, “HSG33. Health and safety in roof work, 5th Edition,” 2020.

[54] Health and Safety Executive , “HSG47, Avoiding danger from underground services, 3rd Edition,” 2014.

[55] Health and Safety Executive, “HSG85, Electricity at work: Safe working practices, 3rd Edition,” 2013.

[56] Health and Safety Executive, “HSR25, The Electricity at Work Regulations 1989: Guidance on Regulations, 3rd Edition,” 2015.

[57] Health and Safety Executive, “L101, Safe work in confined spaces: Confined Spaces Regulations. Approved Code of Practice, 3rd Edition,” 2014.

[58] Health and Safety Executive, “L111, The Control of Major Accident Hazards Regulations 2015: Guidance on Regulations, 3rd Edition,” 2015.

[59] Health and Safety Executive, “Safe use of lifting equipment: Lifting Operations and Lifting Equipment Regulations 1998 Approved Code of Practice and guidance, 2nd Edition,” 2014.

[60] Health and Safety Executive, “L121, Work with ionising radiation: Ionising Radiation Regulations 2017 Approved Code of Practice and guidance, 2nd Edition,” 2018.

[61] Health and Safety Executive, “L22, Safe use of work equipment: Provision and Use of Work Equipment Regulations 1998 Approved Code of Practice and Guidance, 4th Edition,” 2014.

[62] Health and Safety Executive, “L24, Workplace health, safety and welfare. Workplace (Health, Safety and Welfare) Regulations 1992 Approved Code of Practice and guidance, Second Edition,” 2013.

[63] Health and Safety Executive, “L5, Control of substances hazardous to health: The Control of Substances Hazardous to Health Regulations 2002 Approved Code of Practice and guidance, Sixth Edition,” 2013.

[64] Office for Nuclear Regulation, “NS-INSP-GD-074, ONR Technical Inspection Guide: Construction (Design and Management), Issue 3,” 2024.

[65] Holtec Britain, “HI-2240917, Holtec SMR-300 GDA Control of Major Accident Hazards (COMAH) Screening Assessment, Revision 0,” 2024.

[66] Holtec Britain, HI-2250232, UK GDA [DC10] Design Challenge - Conventional Health and Safety, Revision 0, April 2025.

[67] Holtec Britain, “HPP-3295-0017, Design Management Process,” Revision 1, 2024.

[68] Holtec International, HPP-8002-1010, SMR-300 Design Control, Revision 1, May 2025.

[69] Holtec Britain, HPP-3295-0005, Holtec SMR-300 Generic Design Assessment Competency and Training Procedure, Revision 0, April 2024.

[70] Holtec International, HI-2240251, SMR-300 Top Level Plant Design Requirements, Revision 3, March 2025.

[71] Electric Power Research Institute, Report No 3002003129, Advanced Nuclear Technology: Advanced Light Water Reactor Utility Requirements Document, Revision 13, 2014.

[72] Holtec Britain, HI-2241238, Evaluation of Design Concept for SMR-300 Containment Enclosure Structure, Revision 0.1, March 2025 .

[73] Holtec International, “DWG-15400, Modular Constructability of CES, Revision 0,” 2024.

[74] Holtec Britain, “HI-2241363, High-Level Conventional Fire Strategy Document,” Revision 0, February 2025.

[75] Holtec Britain, “HI-2241053, Risk Identification Report for UK Conventional Fire Safety Design,” Revision 0, September 2024.

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

[77] Holtec Britain, “HI-2250420, UK GDA [PDC2] Prospective Design Change - Containment Structure,” Revision 0, May 2025.

[78] Holtec Britain, “HI-2241519, Holtec SMR-300 GDA Conventional Fire Design Challenge [DC 06],” Revision 0, 2025.

12.10 LIST OF APPENDICES

Appendix A PSR Part B Chapter 12 CAE Route Map

Table 4: PSR Part B Chapter 12 CAE Route Map

REDACTED

Appendix B CDM 2015 Regulation 9: Duties of Designers

(1) A designer must not commence work in relation to a project unless satisfied that the client is aware of the duties owed by the client under these Regulations.

(2) When preparing or modifying a design the designer must take into account the general principles of prevention and any pre-construction information to eliminate, so far as is reasonably practicable, foreseeable risks to the health or safety of any person:

(a) carrying out or liable to be affected by construction work;

(b) maintaining or cleaning a structure; or

(c) using a structure designed as a workplace.

(3) If it is not possible to eliminate these risks, the designer must, so far as is reasonably practicable:

(a) take steps to reduce or, if that is not possible, control the risks through the subsequent design process;

(b) provide information about those risks to the principal designer; and

(c) ensure appropriate information is included in the health and safety file.

(4) A designer must take all reasonable steps to provide, with the design, sufficient information about the design, construction or maintenance of the structure, to adequately assist the client, other designers and contractors to comply with their duties under these Regulations.

Appendix C CDM 2015 Regulation 10: Designs prepared or modified outside Great Britain

(1) Where a design is prepared or modified outside Great Britain for use in construction work to which these Regulations apply:

(a) the person who commissions it, if established within Great Britain; or

(b) if that person is not so established, the client for the project,

must ensure that regulation 9 is complied with.

(2) This regulation does not apply to a domestic client.

Appendix D Claim – Risk – Mitigation Map