Partner Document Number	Partner Document Issue /Revision	Retention category:
n/a	n/a	A

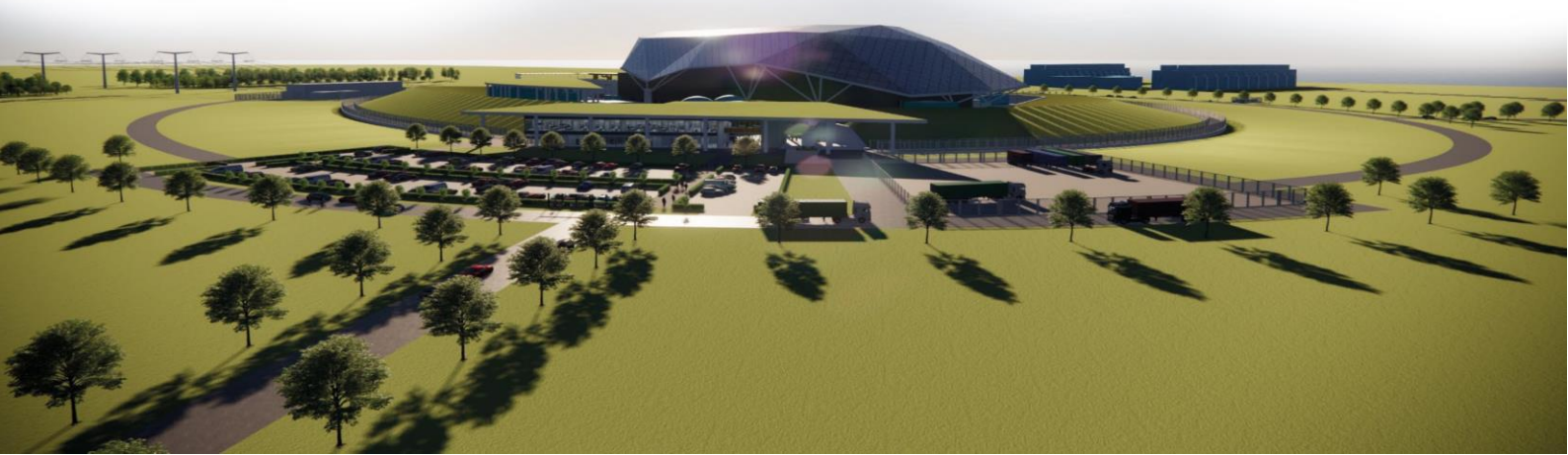
Title

E3S Case Chapter 13: Conduct of Operations

Executive Summary

This chapter of the Environment, Safety, Security and Safeguards (E3S) Case for the Rolls-Royce Small Modular Reactor (RR SMR) presents the arrangements that are being developed, at the Preliminary Concept Definition (PCD) stage of the design programme, to ensure RR SMR can be operated in line with the Operational Limits & Conditions (OLCs) described in E3S Case Chapter 16: Operational Limits & Conditions.

At PCD, the report summarises the operating philosophies that have been developed for RR SMR, which will inform the development of operating procedures by a future dutyholder/licensee. Many aspects of Chapter 13 relate to arrangements for a future dutyholder/licensee that have not yet been developed, including demonstration of a suitable operating organisation, and the development of operational safety and training programmes.



Contents

13.0 Introduction

13.0.1 Introduction to Chapter

Chapter 13 of the Rolls-Royce Small Modular Reactor (RR SMR) Environment, Safety, Security and Safeguards (E3S) Case forms part of the Pre-Construction Safety Report (PCSR) and is a supporting reference to the Generic Environment Report (GER) and Generic Security Report (GSR), which are Tier 1 reports in the E3S Case as defined in E3S Case Chapter 1: Introduction, Reference [1].

Chapter 13 presents the overarching summary of the operational aspects of the RR SMR, as defined at Reference Design (RD) 5 level of design maturity.

13.0.2 Scope

The intent of this chapter is to describe how design and operational documentation developed for RR SMR will facilitate a future dutyholder/licensee to fulfil its prime responsibility to implement E3S in operation, including organisational arrangements, competencies and training programmes (in line with the human factors principles presented in E3S Case Chapter 18: Human Factors Engineering, Reference [2]), operational safety programmes, and operating procedures and guidelines.

The information presented in this revision of the PCSR is largely based on the design definition at the end of Preliminary Concept Definition (PCD). At this design stage, specific details of the future dutyholder/licensee, administrative and operational arrangements have not been developed.

The scope of this revision is therefore limited to a summary of the operational philosophies being developed for the RR SMR concept design, which will be developed to inform the RR SMR operating procedures as the design is developed. Many operational aspects within the scope of this chapter will need to be developed by the future operating organisation in accordance with Licence Condition (LC) compliance arrangements, or equivalent international arrangements.

The operating procedures for RR SMR will need to reflect the Operational Limits and Conditions (OLCs) derived in the E3S analysis and design. OLCs will be presented in E3S Case Chapter 16: Operational Limits and Conditions for Safe Operation, Reference [3], and are not within the scope of this report.

13.0.3 Claims, Arguments, Evidence Route Map

The Chapter level Claim for E3S Case Chapter 13: Conduct of Operations is:

Claim 13: The RR SMR will facilitate development of operational arrangements in accordance with the E3S Case and associated defined limits and conditions.

A decomposition of this Claim into Sub-Claims, Arguments, and link to the relevant Tier 2 Evidence will be presented in future revision of this report. The complete suite of evidence to underpin the Claims in the E3S Case will be generated through the RR SMR design and E3S Case programme and documented in the Claims, Arguments, Evidence (CAE) Route Map [4], described further in E3S Case Chapter 1: Introduction, Reference [1].

13.0.4 Applicable Codes, Standards & Legislation

In GB, the RR SMR will be licensed under the Nuclear Installations Act 1965, Reference [5]. The Office for Nuclear Regulation (ONR) Licence Condition (LC) handbook Reference [6] states the 36 different licensing conditions considered in relation to the granting of a licence, many of which are related to operational aspects covered within the scope of this report.

Various other overarching legislation applies including the Health and Safety at Work etc. Act 1974 and the Ionising Radiations Regulations 2017 (IRR 2017).

The International Atomic Energy Agency (IAEA) establishes safety standards, which are issued in the IAEA Safety Standards Series. This series covers nuclear safety, radiation safety, transport safety and waste safety. SSR-2/2, (Rev.1) Safety of Nuclear Power Plants: Commissioning and Operation Reference [7], specifically details Safety Requirements for Nuclear Power Plants. Specific Safety Guides (SSGs) that are applicable to the conduct of operations include, but are not limited to:

1. SSG-48: Ageing Management and Development of a Programme for Long Term Operation of Nuclear Power Plants, Reference [8]

2. SSG-72: The Operating Organisation for Nuclear Power Plants, Reference [9]

3. SSG-73: Core Management and Fuel Handling for Nuclear Power Plants, Reference [10]

4. SSG-75: Recruitment, Qualification and Training of Personnel for Nuclear Power Plants, Reference [11]

13.1 Plant Procedures and Guidelines

13.1.1 Operating Philosophies

At PCD design stage, operating philosophies are being developed to communicate the key principles related to operation of the RR SMR, and the proposals for operation to align with the requirements of the E3S Case.

A hierarchy of operation philosophies is being developed as illustrated in Figure 13.1-1.

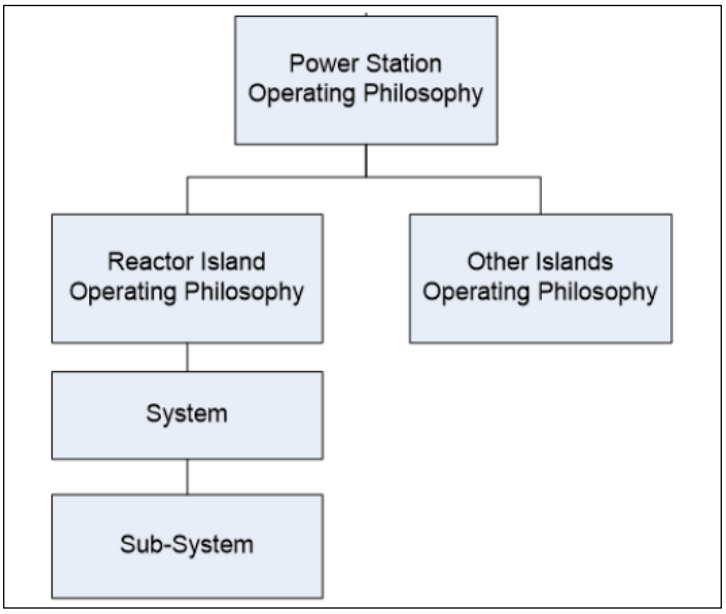


Figure 13.1-1: Relationship between Operational Philosophy Documents

The following operating philosophies have been issued during PCD:

1. Power Station Operating Philosophy, Reference [12]
2. Reactor Island Operating Philosophy, Reference [13]
3. Electrical Operating Philosophy, Reference [14]
4. Control and Instrumentation Operating Philosophy, Reference [15]

The power station operating philosophy provides a high-level description of how the RR SMR will be operated through normal and faulted modes of operation. The general operating principles are outlined, including the power station lifecycle and outage period, operating environment conditions, control, fleet approach, potential staffing numbers and their location.

The supporting 'island' level philosophies provide detailed information on how the plant and operator maintain control of key functions across the six defined operating modes, including the operating principles, required actions, means for transitioning between the operating modes, and relevant safety systems for each mode.

The detail provided within these operating philosophies is not reproduced within this report. Ultimately, the approach for dissemination of philosophies into operating procedures, in line with OLCs, will be formalised and reported in subsequent revisions of the E3S Case as evidence in the CAE Route Map is developed.

Operating Modes

The Reactor Island Operational Philosophy, Reference [16], details the means by which the plant and operator maintain control of key functions across a number of defined operating modes, listed below:

1. Power Operations
2. Low Power
3. Hot Standby
4. Hot Shutdown:
    a. Steaming
    b. Non-Steaming
5. Cold Shutdown:
    a. Cold Shutdown Pressurised
    b. Cold Shutdown Depressurised
6. Refuelling
    a. Refuelling with reduced water level above fuel
    b. Refuelling with water level above nominal

In addition to operating mode specific actions, general operational philosophies and actions are explained, as well as the means of transitioning between the operating dutyholder/licensee.

13.1.2 Administrative and Operating Procedures

Administrative and operating procedures will be developed by the future dutyholder/licensee based on the operating philosophies. This is captured as a commitment on the future dutyholder/licensee:

Commitment on Future Dutyholder/Licensee C13.1: *The future dutyholder/licensee shall develop administrative and operating procedures based on the E3S case and operating philosophies.*

13.1.3 Operational Limits and Conditions

At all times, the RR SMR will be operated in accordance with the E3S Case and associated defined limits and conditions. A detailed list of the OLCs will be developed for the design to

provide the operators with boundaries of operation (i.e., the safe operating envelope), which will be presented in Technical Specifications, operating documents, and procedures. They will include parameters such as temperatures, pressures, status of Systems, Structures and Components (SSCs) and activity limits, and required acceptance criteria (e.g., limits). The OLCs will be informed by the safety analysis and described in E3S Case Chapter 16: Operational Limits & Conditions, Reference [3].

13.1.4 Procedures and Guidelines for Operating the plant during Accidents

The Reactor Island Operating Philosophy, Reference [13], provides preliminary information related to containment management and post-accident arrangements. The approach for dissemination of operational philosophies into procedures will be reported in a future revision of the E3S Case as evidence in the CAE Route Map is developed.

13.2 Nuclear Safety and Security Interfaces

The aims of nuclear safety and nuclear security are complementary; in that both aim to reduce the risk of harm to people and the environment. Hence some protective measures that adequately address the requirements of nuclear safety should also satisfy the requirements for nuclear security.

Details of the safety and operational aspects for security and interfaces with other E3S disciplines will be presented in a future issue of the E3S Case Chapter 32: Generic Security Report.

13.3 Conclusions

13.3.1 Conclusions

At PCD design stage, limited evidence is developed to support the overall claim that 'The RR SMR will facilitate development of operational arrangements in accordance with the E3S Case and associated defined limits and conditions', given many of these aspects will be developed by the future dutyholder/licensee.

The preliminary evidence is limited to operating philosophies developed for the PCD design, which will be developed further as the design progresses to eventually inform the production of operating procedures and Technical Specifications by a future dutyholder/licensee.

13.3.2 Assumptions and Commitments on Future Dutyholder/Licensee

Table 13.3-1: Assumptions and Commitments on Future Dutyholder/Licensee

Assumption/Commitment	ID	Description
Commitment	C13.1	The future dutyholder/licensee shall develop administrative and operating procedures based on the E3S case and operating philosophies.

13.4 References

[1] RR SMR Report, SMR0004294/001, “E3S Case Chapter 1: Introduction,” March 2023.
[2] RR SMR Report, SMR0004520/001, “E3S Case Chapter 18: Human Factors,” March 2023.
[3] RR SMR Report, SMR0004555/001, “E3S Case, Chapter 16: Operational Limits and Conditions,” March 2023.
[4] RR SMR Report, SMR0002155/001, “E3S Case CAE Route Map,” March 2023.
[5] gov.uk, “Nuclear Installations Act,” gov.uk, 1965.
[6] ONR, “Licence Conditions Handbook,” February 2017.
[7] IAEA, “SSR-2/2 (Rev.1), Safety of Nuclear Power Plants: Commissioning and Operations,” February 2016.
[8] IAEA SSG-48, “Ageing Management and Development of a Programme for Long Term Operation of Nuclear Power Plants,” November 2018.
[9] IAEA SSG-72, “The Operating Organsation for Nuclear Power Plants,” September 2022.
[10] IAEA SSG-73, “Core Management and Fuel Handling for Nuclear Power Plants,” September 2022.
[11] IAEA SSG-75, “Recruitment, Qualification and Training of Personnel for Nuclear Power Plants,” October 2022.
[12] RR SMR Report EDNS01000912618/001, “Power Station Operating Philosophies,” January 2021.
[13] RR SMR Report EDNS01000903077/001, “Reactor Island Operating Philosophies,” October 2020.
[14] RR SMR Report EDNS01000949469/001, “Electrical Operating Philosophies,” February 2021.
[15] RR SMR Report EDNS01000951939/001, “Control and Instrumentation Operating Philosophies,” March 2021.

13.5 Acronyms and Abbreviations

CAE	Claims, Arguments, Evidence
E3S	Environment, Safety, Security and Safeguards
GER	Generic Environmental Report
GSR	Generic Security Report
IAEA	International Atomic Energy Agency
LC	Licence Condition
ONR	Office for Nuclear Regulation
PCD	Preliminary Concept Definition
PCSR	Pre-Construction Safety Report
RD	Reference Design
RR SMR	Rolls-Royce Small Modular Reactor
SSC	Structure, System, Component