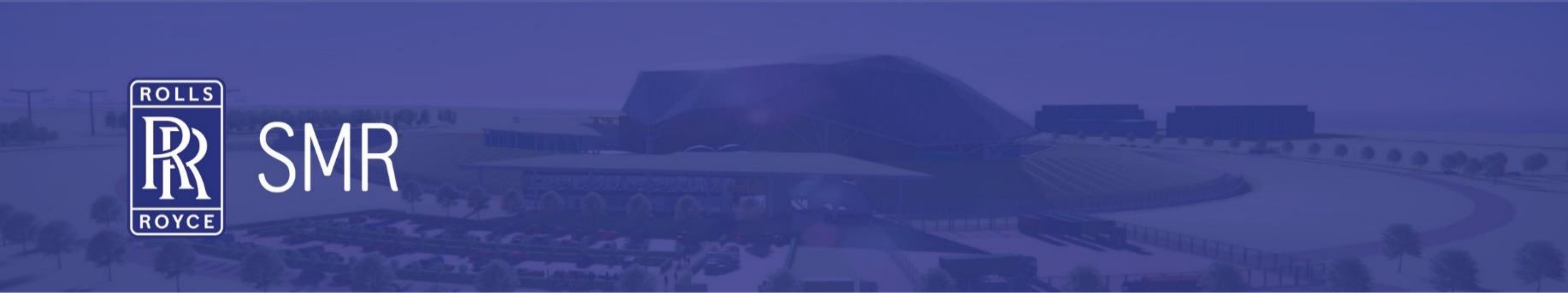

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Title

E3S Case Chapter 33: Safeguards

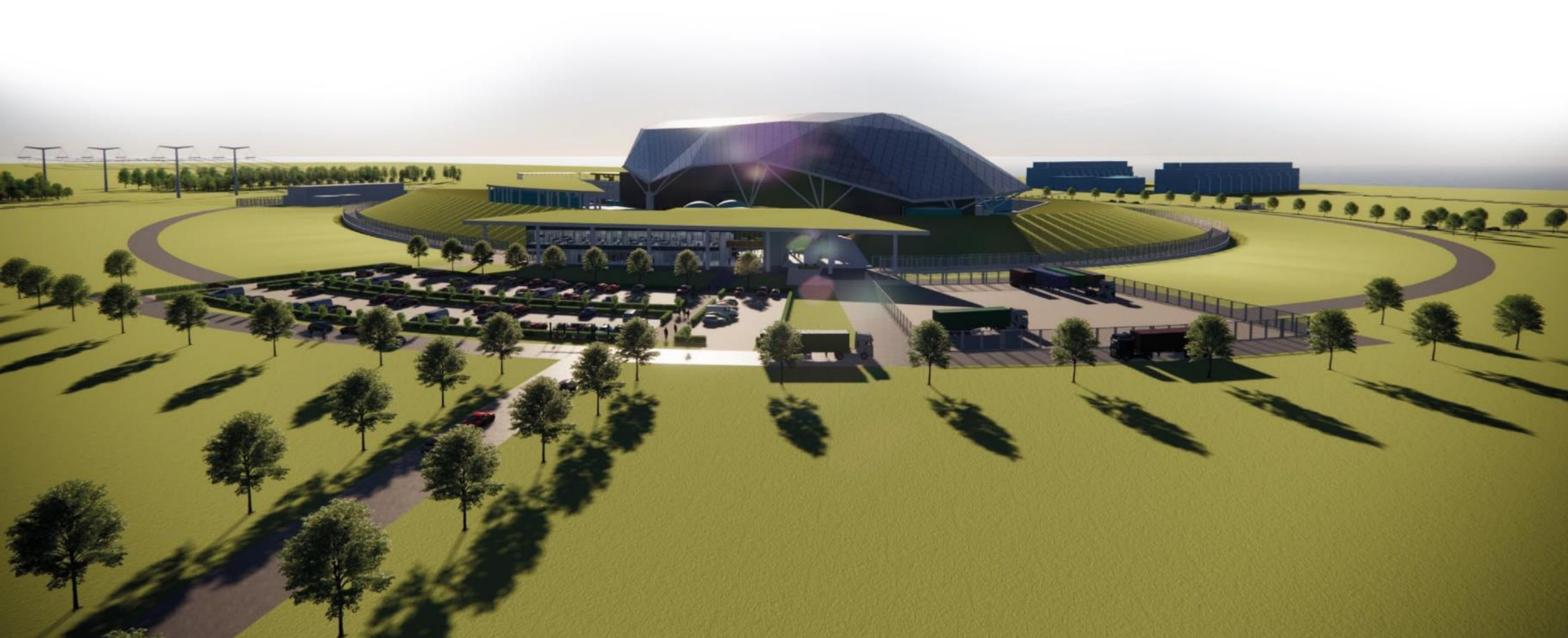
Executive Summary

This chapter of the Environment, Safety, Security, and Safeguards (E3S) Case presents the Safeguards of the Rolls-Royce Small Modular Reactor (RR SMR).

Safeguards are defined as the measures to verify that countries abide by their commitments to use Qualifying Nuclear Materials (QNM) (plutonium, uranium, and thorium) for declared peaceful purposes.

An overview of the United Kingdom (UK) and international Relevant Good Practice (RGP) for Safeguards that is applicable to RR SMR is presented in this revision.

To ensure the design can facilitate all Safeguards expectations, requirements are being developed from the UK and international RGP for Safeguards and will be placed onto the design prior to the Final Concept Definition (FCD) engineering milestone. These will be reported in Issue 2 of the E3S Case.



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33.0 Introduction

33.0.1 Introduction to Safeguards with respect to RR SMR

Chapter 33 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 Security Report (GSR), which is a Tier 1 report in the E3S Case as defined in E3S Case Chapter 1: Introduction, Reference [1].

Chapter 33 presents the overarching summary and entry point for the consideration of the Safeguards in the design of the RR SMR, as defined at Reference Design (RD) 5 level of design maturity.

Safeguards are measures to verify that countries abide by their commitments to use Qualifying Nuclear Materials (QNM) (plutonium, uranium, and thorium) for declared peaceful purposes. They are an international confidence based on independent verification by international Safeguards inspectors and form a cornerstone of the global nuclear non-proliferation regime.

Safeguards inspections are carried out by the Office for Nuclear Regulation (ONR), which is responsible for delivering the State System for Accountancy and Control for United Kingdom (UK) Nuclear Power Plants, European Atomic Energy Community (EURATOM), who perform a similar role for the European Commission and the International Atomic Energy Agency (IAEA) who have worldwide oversight of Safeguards.

The objective of IAEA Safeguards is the timely detection of diversion of nuclear material from peaceful activities, and the deterrence of such diversion by the risk of early detection. To facilitate the implementation of Safeguards, the IAEA establishes high level facility specific safeguards guidelines and communicates these to stakeholders at appropriate times during the design process. The IAEA is promoting Safeguards by Design (SBD) as an approach whereby international Safeguards are fully integrated into the design process of a nuclear facility, Reference [2].

Safeguards are captured in RR SMR E3S Principles, Reference [3] which will be promulgated into the design with specific functional requirements. Those Systems, Structures and Components (SSCs) important to Safeguards, e.g. uninterruptible power supplies, will be tagged as important to ensuring Safeguards, this ensures that future design iterations maintain all features necessary for Safeguards. The plant is designed with Safeguards in mind from the very beginning, incorporating Safeguards by Design as detailed in Section 33.1.4 of this chapter.

33.0.2 Scope

The scope of this chapter covers specific areas detailing SBD for the RR SMR, including how the design facilitates material accountability, and containment and surveillance (C/S). It also outlines the key United Kingdom (UK) and international standards, regulations, and Relevant Good Practice (RGP) which have been considered during the design of the RR SMR.

For IAEA Safeguards purposes, the containment used in a C/S system consists of structural features of a nuclear facility or of equipment which permit the IAEA to establish the physical integrity of an area or item by preventing undetected access to, movement of, nuclear or other material, or interference with the item, IAEA Safeguards equipment, or data. Examples are the walls of a storage room or a storage pool, transport flasks and storage containers. The continued integrity of the containment is ensured by containment examination, and by C/S measures for penetrations of the containment such as doors, vessel lids and water surfaces.

Similarly, surveillance is the collection of information through inspector and/or instrumental observation, which is aimed at monitoring the movement (or non-movement) of nuclear material, detecting interference with the containment, or tampering with IAEA Safeguards devices, samples, or data. There is a range of surveillance devices available, and the use of any one depends on the individual circumstances.

Physical Security aspects of SBD are presented within the E3S Case Chapter 32, Generic Security Report (GSR), Reference [4].

Design/Programme Maturity

The Safeguards presented in this revision of the E3S Case are largely based on the design definition at the end of the Preliminary Concept Definition (PCD) design stage. PCD is an interim design stage representing RD5 level of design maturity, at which point Safeguards principles, standards, and expectations have been identified, as referred to throughout this report.

The RR SMR continues to be developed through to the next design stage, Final Concept Definition (FCD). Safeguards requirements are to be developed and placed onto the design prior to FCD design maturity.

33.0.3 Claims, Arguments, Evidence Route Map

The Chapter level Claim for E3S Case Chapter 33: Safeguards is:

Claim 33: RR SMR layout and design facilitates nuclear material accountancy and minimises the potential for diversion of Nuclear Material

A decomposition of this Claim into Sub-Claims, Arguments, and link to the relevant Tier 2 Evidence is provided in Appendix A. For each lowest level Sub-Claim, the sections of this report providing the Evidence summary are also identified. Further information will be presented in future revisions of this report as evidence in the Claims, Arguments, Evidence (CAE) Route Map, Reference [5], is developed.

33.1 International and National Standards and Regulations

33.1.1 International

The legal basis for IAEA Safeguards in the UK is represented in Figure 33.1-1.

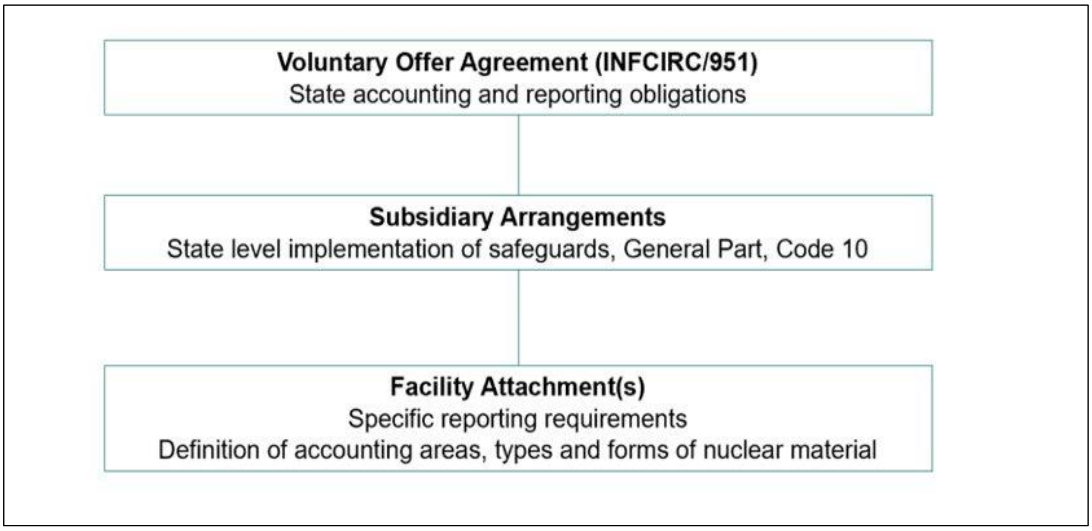

Figure 33.1-1: International Legal Basis for Safeguards

The UK has concluded agreements with international stakeholders, which are relevant to this document. These specifically are agreements with the IAEA, Reference [6].

The relevant international agreements are defined in the Nuclear Safeguards (Fissionable Material and Relevant International Agreements) (EU Exit) Regulations 2019. (NSR 19), Reference [7].

While nuclear material accountancy at nuclear facilities remains fundamental, the use of other information relevant to Safeguards means that Safeguards at similar facility types may differ from State to State, as well as from facility to facility within the same State. Therefore, no single specification exists for Safeguards implementation, Reference [8].

Safeguards techniques and measures used by the IAEA can include:

1. On-site inspections by IAEA inspectors
2. Definition of Material Balance Areas (MBAs) for nuclear material accounting
3. Definition of Key Measurement Points for measuring flow and inventories of nuclear material
4. Unique identifiers for nuclear material items
5. Locations for surveillance, containment and monitoring, and other verification measures of nuclear material

6. Review of operating records and State reports

7. Annual Physical Inventory Verification (PIV), which will generally be performed during facility shutdown; routine interim inventory verifications (monthly, quarterly, annual or random)

8. Verification of transfers of nuclear material to and from the site

9. Statistical assessment of the nuclear material balance to evaluate material unaccounted for

10. Reactor power monitoring

11. Verification of facility design at all stages from construction onward for features relevant to Safeguards

12. Verification of the performance of the Dutyholder/Licensee measurement system

33.1.2 United Kingdom

The legal basis for Safeguards in the UK is represented in Figure 33.1-2.

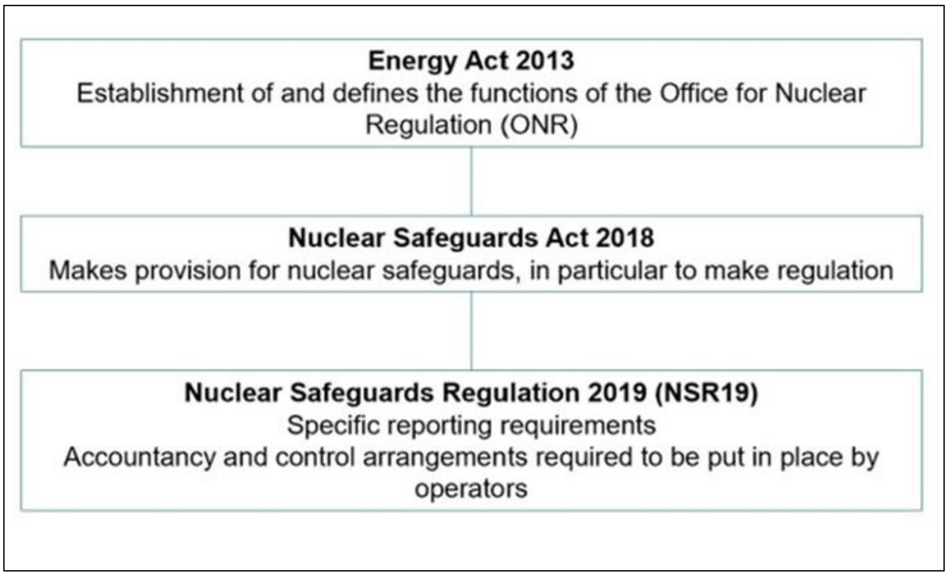

Figure 33.1-2: UK Legal Basis for Safeguards

The overriding legalisation in the UK are the Nuclear Safeguards Regulations (NSR) 19, Reference [7]. Parts of NSR 19 are prescriptive and often related to enabling the UK to fulfil its international nuclear Safeguards obligations, and parts are outcome focused, in line with the extant regulatory approach applied within the UK across most industries, including nuclear.

ONR Nuclear Material Accountancy, Control, and Safeguards Assessment Principles (ONMACS) defines Fundamental Safeguards Expectations (FSEs), Reference [9], based on the requirements of UK law (NSR19), relevant international agreements, and in accordance with relevant good practice. FSEs are detailed in Table 33.1-1.

Table 33.1-1: Fundamental Safeguards Expectations

FSE No	FSE Description
FSE 1	Leadership and Management for Nuclear Material Accountancy, Control and Safeguards (NMACS)
FSE 2	Organisational Culture
FSE 3	Competence Management
FSE 4	Reporting Anomalies and Investigations
FSE 5	Reliability, Resilience and Sustainability
FSE 6	Measurement Programme and Control
FSE 7	Nuclear Material Tracking
FSE 8	Data Processing and Control
FSE 9	Material Balance
FSE 10	Quality Assurance and Control for Nuclear Material Accountancy, Control and Safeguards

There is a legal requirement for a Dutyholder/Licensee to have in place an adequate NMACS, that may include, but not be limited to: a physical inventory, Closed-Circuit Television (CCTV) and access points to enable material accountancy and surveillance in the fuel route.

This is captured in the following Commitment on Future Dutyholder/Licensee:

Commitment on Future Dutyholder/Licensee C33.1: *The future Dutyholder/Licensee shall put into place an adequate Nuclear Material Accountancy and Control System (NMACS) for Safeguards*

FSEs underpin all activities that contribute to sustain high standards of NMACS. They fall into two categories:

1. Strategic enablers – FSEs 1-5 are expectations focussed on creation of the right conditions to support effective NMACS strategy

2. Material controls – FSEs 6-10 are expectations focussed on implementation and maintenance of effective and robust NMACS arrangements

The Office for Nuclear Regulation (ONR) may consult with a Dutyholder/Licensee on what Safeguards equipment is appropriate for a qualifying nuclear facility and will facilitate interactions with the IAEA as part of the Generic Design Assessment (GDA) process in GDA Step 3.

On receipt of a written request from the ONR, a Dutyholder/Licensee must install suitable Safeguards equipment in each qualifying nuclear facility to provide independent confirmation that the information recorded by the operator or provided by the operator to the ONR or to the IAEA, is accurate and up to date.

NSR 19 places a duty on Dutyholders/Licensees to establish, implement and maintain a system of accountancy and control of QNM in each Qualifying Nuclear Facility (QNF). Dutyholders/Licensees must also ensure that arrangements are in place to provide the accounting reports required by NSR19.

Dutyholders/Licensees are required under NSR 19 to make a number of submissions to the ONR, these are specified in Reference [10] and include but are not limited to: Declaration of Basic Technical Characteristics (BTC) of a QNF, an Annual Outline Programme of Activities, an Accountancy and Control Plan and Accounting Reports, Reference [9].

This is captured in the following Commitment on Future Dutyholder/Licensee:

Commitment on Future Dutyholder/Licensee C33.2: *The future Dutyholder/Licensee shall establish, implement, and maintain an accountancy and control system of Qualifying Nuclear Materials in each Qualifying Nuclear Facility, to enable provision of reporting requirements under Nuclear Safeguards Regulations (NSR) 19*

33.1.3 Other Relevant Good Practice

The publications in the IAEA Nuclear Energy Series present good practices and advances in technology, as well as practical examples and experience in the areas of nuclear reactors, the nuclear fuel cycle, radioactive waste management and decommissioning, and on general issues relevant to nuclear energy.

RGP can be found in the National Occupational Standards (NOS) for Nuclear Material Accountancy and Safeguards, which provide a suite of standards that cover the activities carried out by individuals working on behalf of Dutyholders/Licensees to meet NMACS, Reference [9].

The measurement and accountancy systems of QNFs should comply with relevant good practice such as those set out in ISO standards, e.g., ISO/IEC 17025:2017, Reference [11] and ISO 10012:2013 Reference [12] This criterion also applies where accounting reports are based on calculations (i.e., burn-up declarations and nuclear production and loss occurring in power reactors).

33.1.4 Safeguards by Design

SBD, Reference [2], is the process of including the consideration of international Safeguards throughout all phases of a nuclear facility project, from the initial conceptual design to facility construction and into operations, including design modifications and decommissioning. The ‘by design’ concept encompasses the idea of preparing for the implementation of Safeguards in the management of the project during all these stages. Safeguards by design does not introduce new requirements but rather presents an opportunity to facilitate the cost-effective implementation of existing requirements.

SBD provides guidance to State authorities, designers, equipment providers and prospective Dutyholders/Licensees, on the importance of taking international Safeguards into account when designing a nuclear facility or process. A voluntary best practice, SBD allows for informed design choices that optimize economic, operational, safety and security factors, in addition to international Safeguards. It is applicable to all aspects of the nuclear fuel cycle. For new nuclear facilities, especially novel designs, or processes, the earlier the discussion of Safeguards the better: SBD allows for Safeguards to be built 'into' the system, rather than around it afterwards.

33.2 Design for Safeguards

33.2.1 Introduction

RR SMR is incorporating SBD in line with international best practice and guidance. This will benefit the design by avoiding costly and time-consuming retrofits or redesigns of the facility to accommodate Safeguards; Whilst easily enabling the implementation of international Safeguards for the Dutyholder/Licensee, the State, and the IAEA.

33.2.2 E3S Principles

E3S Principles are derived from UK and International good practice and guidance. Reference [3] states "The design shall permit provision of Safeguards in line with international obligations. The design should permit safeguard measures that provide:

1. Material Accountability – tracking all inward and outward transfers and the flow of materials. This includes sampling and analysis of nuclear material, on-site inspections, review, and verification of operating records

2. Physical Security – restricting access to nuclear materials at the site of use

3. Containment and Surveillance – automatic cameras and other instruments to detect unreported movement or tampering with nuclear materials

The design should provide Safeguards by design so far as is reasonably practicable. Safeguards by design include incorporation of equipment, space and support services required for inspection and verification activities within the design."

Specific details of how RR SMR facilitates the above will be presented within the BTC.

33.2.3 Safeguards Requirements

Detailed IAEA design criteria for Safeguards equipment or systems might only be specified late in the design life cycle, Reference [8]. The RR SMR design process will allow for the provision of cabling, power, data transmission and penetrations for such equipment and systems at an early design stage. Specific details will be presented in the BTC. The ability to provide access to stable, reliable power and access to secure data transmission capability throughout RR SMR will prevent some of the costliest aspects of retrofitting for Safeguards equipment systems and allow flexibility for future Safeguards technology installation.

The implementation of Safeguards can be facilitated by such things as:

1. Simplifying the path of nuclear material through the facility and the number of locations where it is stored

2. Understanding Safeguards use of containment, authentication of data, and continuity of knowledge

3. Installing a robust automated accounting system that provides all necessary reports electronically

4. Providing physical access and access to data for verification purposes

Candidate requirements to facilitate the implementation of Safeguards will be developed and placed on the design prior to FCD in line with the CAE route map.

33.2.3 Material Accountability

All QNM shall be accounted for from arrival at the facility until it leaves site, this is known as Material Accountability. The BTC will detail specific QNM as applicable to RR SMR.

The BTC will define the facilities MBA and all QNM will be located within it. An MBA is an area where the quantity of nuclear material in each transfer into or out of the MBA can be determined and the physical inventory of nuclear material can be determined.

The locations, within the MBA, in which QNM can be held will be defined as Key Measurement Points (KMP).

Inventory KMPs are generally located in fuel storage areas: fresh fuel storage, reactor core and reactor spent fuel storage. Current thinking is that Flow key measurement points will be located at fuel transfer sites: such as fresh fuel receipt and inspection area, fuel transfers from fresh fuel storage to the reactor core, irradiated fuel transfer from the reactor core to spent fuel pool, transfer of recirculating core fuel, transfer of spent fuel to storage and spent fuel transfer/shipment from the MBA/facility. Specific information will be detailed within the BTC.

Figure 33.2-1 shows a simplified flow of QNM through RR SMR along with examples of KMPs.

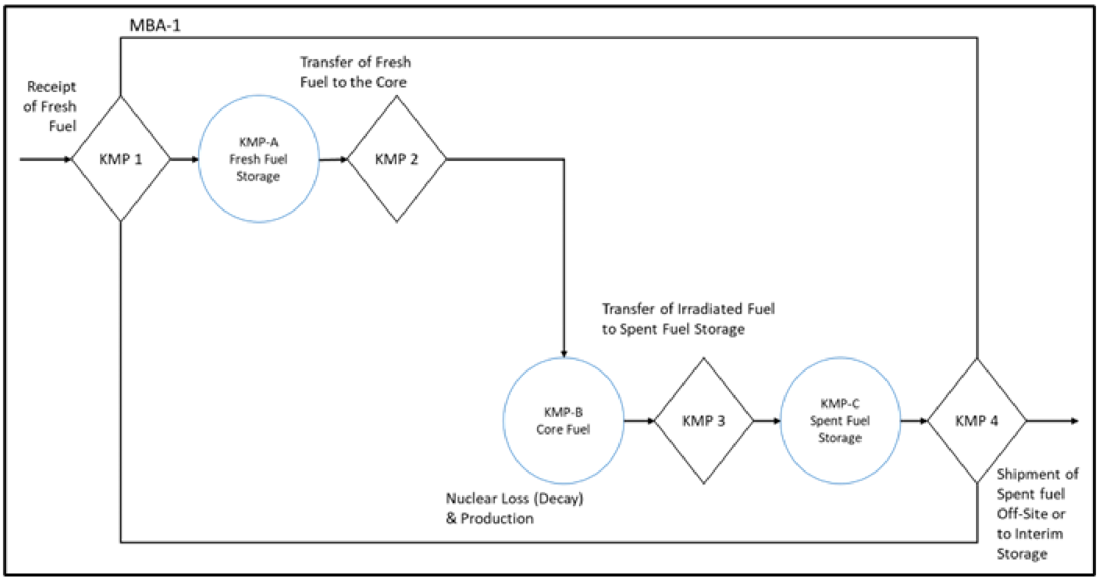

Figure 33.2-1: Example of Fuel Flow through RR SMR

In summary, fuel will arrive at the New Fuel Receipt and Inspection Area [FAA] within fuel transport containers with an IAEA seal. The transport containers will remain in this area, under surveillance, until the seal is broken. At this point it is expected that individual assemblies will be inspected and recorded within the NMACS.

Fuel assemblies are transferred to the Spent Fuel Pool (SFP) [FAB10] and onwards via the Fuel Transfer Channel [FCK] to the Refuelling Pool [FAF] and Refuelling Cavity [FAE] within the reactor. Following irradiation, fuel assemblies and other radioactive parts are stored in the SFP [FAB10], which is used for interim storage of fuel, fuel inspection, fuel repair and cask loading. A variety of inspections are expected to take place on fuel assemblies and control rods, such as visual, ultrasonic, gamma ray spectroscopy, eddy current (oxide/coating thickness and defect testing), in-mast and in-pool sipping, and dimensional measurement. It is expected that the SFP will be under constant surveillance and that the Fuel Transfer Channel will be secured with security seals when not in use. An inventory will record where specific fuel assemblies are located e.g., SFP, Refuelling Pool or reactor cavity.

To support the safe operation and control of the refuelling system, the Electrical, Control and Instrumentation (EC&I) system will be required to monitor a range of key system parameters and provide appropriate indication. It is expected that the EC&I system will be required to monitor and indicate fuel storage positions and allow identification of individual fuel assemblies and any individual damaged rods that have been removed from fuel assemblies. Closed-Circuit Television (CCTV) and other SSCs for operability, fuel inspection and nuclear material accountancy, will be incorporated into the design.

After 6-10 years of fuel cooling in the SFP [FAB10], it is desirable to transfer fuel into dry storage and to move the fuel to a different storage location to minimise the size of the SFP in the reactor island building. The benefits are a reduced footprint for the SFP and the movement of fuel into a long term, fully passive storage system. Further work is required to gain more certainty over whether 10 years of cooling is required before transfer to dry storage.

The RR SMR is expected to use dry concrete cask storage for the interim storage of spent fuel and other nuclear equipment, as described in Reference [13]. Typical dry concrete storage casks include a thin-walled Multiple Purpose Canister (MPC), which is placed within a large concrete storage cask. During loading within the Cask Loading Pit [FAB20], the MPC is placed inside a metal on-site transfer cask. Following sealing, lid welding, draining, helium fill and inspection, the MPC is transferred to the dry concrete storage cask and removed to dry store. Further detail on the dry store for spent fuel and other nuclear equipment will be detailed in the BTC.

33.2.4 Physical Security

Physical Security will be detailed within the E3S Case: Chapter 32, Generic Security Report. Reference [4].

33.2.5 Containment and Surveillance

Maintaining ‘continuity of knowledge’, Reference [8], refers to the process of using surveillance, containment, and monitoring measures to maintain already verified Safeguards information by detecting any efforts to alter an item’s properties which are relevant to Safeguards.

When continuity of knowledge is maintained successfully, it can reduce the amount of remeasurement activity in subsequent inspections. Equipment that facilitates continuity of knowledge can include cameras within Reactor Island monitoring core activities, IAEA installed seals on containment penetrations and important fuel transfer channels and Non-Destructive Assay (NDA) measurements of fresh and irradiated fuel.

Design work is ongoing and will ensure continuity of knowledge. Safeguards requirements on the design are likely to include but are not limited to:

1. Illumination must be adequate and continuous for surveillance; it must not impinge on any ultraviolet spectrums that Post Irradiation Equipment (PIE) might use

2. Water clarity, within the SFP [FAB10] must allow visual inspection and identification of specific fuel assemblies and damaged fuel rods, that may have been removed from fuel assemblies

3. Fuel storage racks should allow identification of all individual fuel assemblies and SSCs. If racks are to be stacked, seals can be used on lower racks to preserve continuity of knowledge of their inventory, should subsequent racks obscure visual identification

33.3 Conclusions

33.3.1 Conclusions

To ensure the design can facilitate all Safeguards expectations, requirements are being developed from UK and international RGP for Safeguards. These will be placed as candidate requirements onto the design prior to FCD. These requirements will support the overall claim that 'RR SMR layout and design facilitates nuclear material accountancy and minimises the potential for diversion of Nuclear Material through the lifecycle', which contributes to the overall E3S objective to protect people and the environment from harm, and the demonstration that risks are reduced As Low As Reasonably Practicable (ALARP).

33.3.2 Assumptions & Commitments on the Future Dutyholder/Licensee

Assumptions and commitments raised on the future Dutyholder/Licensee are summarised in Table 33.3-1.

Table 33.3-1: Assumptions and Commitments on Future Dutyholder/Licensee

Assumption/ Commitment	ID	Description
Commitment	C33.1	The future Dutyholder/Licensee shall put into place an adequate Nuclear Material Accountancy and Control System (NMACS) for Safeguards
Commitment	C33.2	The future Dutyholder/Licensee shall establish, implement, and maintain an accountancy and control system of Qualifying Nuclear Materials in each Qualifying Nuclear Facility, to enable provision of reporting requirements under Nuclear Safeguards Regulations (NSR) 19

33.4 References

[1] RR SMR Report, SMR0004294/001, "E3S Case Chapter 1: Introduction," March 2023.
[2] IAEA, "IAEA Nuclear Energy Series No NP-T2-8 International Safeguards in Nuclear Design and Construction," 2013.
[3] RR SMR Report, SMR0001603/001, "Environment, Safety, Security and Safeguards Design Principles," 2022.
[4] RR SMR Report, SMR0004682/001, "E3S Case Chapter 32: Generic Security Report," March 2023.
[5] RR SMR Report, SMR0002155/001, "E3S Case Route Map," March 2023.
[6] IAEA, Legal framework for IAEA Safeguards ISBN 978-92-0-141810-4, 2013.
[7] UK Government, "UK Statutory Instrument Number 196," London, 2019.
[8] IAEA Nuclear Energy Series, No, NP-T-2.9, "International Safeguards in the Design of Nuclear Reactors," August 2014.
[9] ONR-CNSS-MAN-001Rev5, "ONR Nuclear Material Accountancy, Control, and Safeguards," 2022.
[10] ONR, SG-TAST-GD-001, "Safeguards Technical Assessment Guide," January 2021.
[11] ISO, "ISO/IEC 17025:2017 - General requirements for the competence of testing and calibration laboratories," ISO, 2017.
[12] ISO, ""ISO 10012:2003 - Measurement management systems — Requirements for measurement processes and measuring equipment," ISO, 2003.
[13] RR SMR Report, EDNS01000915124/001, "Spent Fuel Storage Optioneering," February 2021.

33.5 Appendix A: CAE Route Map for Chapter 33

33.5.1 CAE Route Map

A preliminary Claims decomposition from the overall Chapter 33 Claim is summarised in Table 33.5-1, including the Tier 2 Evidence underpinning the Claims at PCD (i.e., summarised in Revision 1 of this report) and further Tier 2 Evidence still to be developed.

Table 33.5-1: CAE Route Map for Chapter 33

Level 1 Claims	**Level 2 Claims**	**Level 3 Claims**	**Arguments**	**Evidence Summary within Chapter 33**	**Underpinning Tier 2 Evidence** ***at PCD**	**Underpinning Tier 2 Evidence** ***to be developed**
Safeguards requirements are derived and justified based on sound safety principles and methods			Safeguards requirements are being developed in line with UK and international standards and legislation	Sections 1, 2.3	n/a	Dynamic Object Orientated Requirements System (DOORS) Safeguards Requirements Module
The RR SMR layout and design facilitates the ability to track the flow of Nuclear Material and undertake on-site inspections		-	-	Section 2.4	n/a	Basic Technical Characteristics Report

Level 1 Claims	**Level 2 Claims**	**Level 3 Claims**	**Arguments**	**Evidence Summary within Chapter 33**	**Underpinning Tier 2 Evidence** ***at PCD**	**Underpinning Tier 2 Evidence** ***to be developed**
The RR SMR design minimises potential for diversion of Nuclear Material	The RR SMR design facilitates the provision of cameras and instrumentation to detect movement or tampering with Nuclear Material	-	-	Section 2.6	n/a	Basic Technical Characteristics Report
	Access to Nuclear Material within the site is appropriately restricted	-	-	n/a	n/a	E3S Case Chapter 32: Security

33.6 Acronyms and Abbreviations

ALARP	As Low As Reasonably Practicable
BTC	Basic Technical Characteristics
CAE	Claims, Arguments, Evidence
CCTV	Closed-Circuit Television
C/S	Containment/Surveillance
DOORS	Dynamic Object Orientated Requirements System
E3S	Environmental, Safety, Security and Safeguards
EC&I	Electrical, Control and Instrumentation
EURATOM	European Atomic Energy Community
FCD	Final Concept Definition
FSE	Fundamental Safeguards Expectation
GDA	Generic Design Assessment
IAEA	International Atomic Energy Agency
IEC	International Electrotechnical Commission
INFCIRC	Information Circular
ISO	International Organization for Standardization
KMP	Key Measurement Point
MBA	Material Balance Area
MPC	Multi-Purpose Canister
NDA	Non-Destructive Assay
NMACS	Nuclear Material Accounting and Control System
NOS	National Occupational Standards
NSR	Nuclear Safeguards Regulation

ONR	Office for Nuclear Regulation
ONMACS	ONR Nuclear Material Accountancy, Control and Safeguards
PCD	Preliminary Concept Definition
PCSR	Pre-Construction Safety Report
PIE	Post Irradiation Equipment
QNF	Qualifying Nuclear Facility
QNM	Qualifying Nuclear Material
RD	Reference Design
SBD	Safeguards by Design
SFP	Spent Fuel Pool
SSC	Structures, Systems and Components