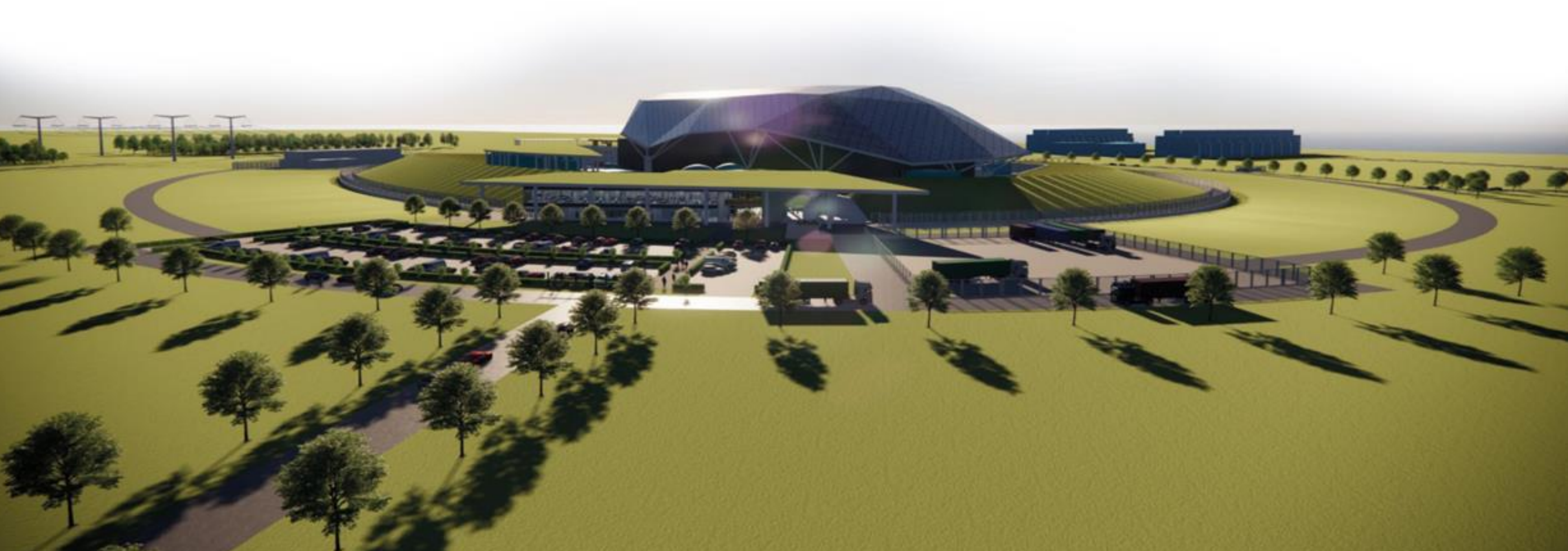
Environment, Safety, Security and Safeguards Case Version 2, Tier 1, Chapter 31: Conventional Environmental Impact and Other Environmental Regulations



Record of Change

Date	Revision Number	Status	Reason for Change
March 2023	1	Issued	Formal Issue.
March 2023	2	Issued	Final issue to rectify formatting errors and for regulator submission.
May 2024	3	Issued	Updated to correct revision history status at Issue 2. Chapter changes include: • Alignment of chapter to RD7/DRP1 • Updated water use values and information on abstraction from Tier 2 documents (Section 31.2) • Discharges to surface water updated with information from Tier 2 documents (Section 31.3) • Further combustion activity information on diesel generators and mobile fired boilers from Tier 2 documents (Section 31.5) • Environmentally significant SSCs added into Appendix B (Section 31.11.1) Also, minor template/editorial changes for overall E3S Case consistency.

Executive Summary

This is chapter 31 of the Environment, Safety, Security and Safeguards (E3S) Case for the Rolls-Royce Small Modular Reactor (RR SMR). Chapter 31 has been based upon the design information available at reference design (RD) 7/design reference point (DRP) 1.

The chapter presents information on the conventional (non-radioactive) environmental aspects of the RR SMR within the scope of the generic E3S case relevant to the RR SMR and addresses the following topics:

- Water use and abstraction
- Discharges to surface water
- Discharges to groundwater
- Operation of installations (combustion plant and incinerators)
- Control of major accident hazards (COMAH) regulations
- Fluorinated greenhouse gases and ozone-depleting substances.

For each of these topics, the chapter summarises the applicable regulations, describes the relevant aspects of the RR SMR operations at RD7/DRP1, and identifies future assessments and design activities.

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31.1 Introduction to Chapter

31.1.1 Introduction

This is chapter 31 of the Rolls-Royce Small Modular Reactor (RR SMR) Environment, Safety, Security and Safeguards (E3S) Case. Chapter 31 is a Tier 1 report in the E3S Case as defined in E3S Case Version 2, Tier 1, Chapter 1: Introduction [1].

This chapter presents information on the conventional (non-radioactive) environmental aspects of the design and has been issued based upon the design information available following the completion of reference design (RD) 7/design reference point (DRP) 1.

The objectives of the final iteration of this chapter are to:

1. Demonstrate that conventional environmental aspects associated with the RR SMR have been identified and are appropriately understood for the detailed design phase.

2. Demonstrate that relevant environmental regulations associated with conventional environmental impacts are appropriately identified and the impact of those regulations on the design of the RR SMR are understood.

3. Demonstrate how the conventional environmental impacts associated with the RR SMR are being prevented or, where this is not possible, managed to minimise their environmental impact, taking into consideration legal requirements and relevant good practice (RGP).

31.1.2 Scope and Maturity

Chapter 31 follows the structure of the “Information relating to other environmental regulations” section within the “Information required for environment case as submission” part of the requesting parties (RP) generic design assessment (GDA) guidance [2]. As such, it addresses the following topics:

- Water use and abstraction
- Discharges to surface water
- Discharges to groundwater
- Operation of installations (combustion plant and incinerators)
- Control of major accident hazards (COMAH) regulations
- Fluorinated greenhouse gases and ozone-depleting substances.

For each of these topics, the chapter provides the regulatory context, describes the relevant aspects of the RR SMR as currently configured (at RD7/DRP1), and identifies future assessments and design activities.

Chapter 31 to some extent also covers conventional aspects of environmental sustainability, capturing topics of resource efficiency and usage, management of effluents and emissions, and potential sustainable design opportunities. However, this will be captured specifically in more detail within the future E3S Case Version 4, Tier 1, Chapter 26: Sustainability.

This iteration of chapter 31 does not formally identify environment protection functions (EPFs) yet does identify some environmentally significant structures, systems and components (SSCs) that contribute towards environment protection measures (EPM) [3] (see Appendix B, Section 31.11.1). These will be reviewed and further SSCs added in future iterations of chapter 31.

It should be noted that there are additional conventional environmental aspects that will be appropriately considered during the design of the RR SMR but are outside the scope of the generic E3S Case and this iteration of chapter 31. This includes, for example:

- Conventional solid waste
- Amenity impacts
- Visual impacts
- Noise and odour impacts
- Terrestrial ecology.

All conventional environmental aspects, including those outside the scope of the generic E3S Case, will be assessed within future versions of the site specific E3S Case.

E3S Case Version 2, Tier 1, Chapter 31 is based upon information available at RD7/DRP1 of the RR SMR.

As the RR SMR design is continuing to mature, the conclusions of this chapter will identify a forward look of information still to be developed in order for chapter 31 to achieve the generic E3S Case objective.

31.1.3 Claims, Arguments and Evidence Route Map

The overall approach to claims, arguments, evidence (CAE) and the set of E3S claims to achieve the generic E3S Case objective are described in E3S Case Version 2, Tier 1, Chapter 1: Introduction [1]. The associated top-level claim for this chapter is:

Claim 31: The conventional environmental impacts of the RR SMR are minimised.

A detailed decomposition of this claim into sub-claims, arguments and mapping to relevant Tier 2 and Tier 3 evidence is presented in the E3S Case CAE Route Map [4].

This chapter provides evidence that will support the arguments needed to satisfy the top-level claim listed above and those within the E3S Case CAE Route Map [4]. It is recognised that the chapter reflects a point in time and that further engineering design is to be undertaken that will further underpin the top-level claim associated with conventional environmental aspects.

A mapping of the claims to the corresponding sections that summarise the arguments and/or evidence is provided in Appendix A, Table 31.10-1.

31.1.4 Applicable Regulations, Codes and Standards

There are a series of United Kingdom (UK) regulations, codes and standards that apply to discharges of conventional effluents and water usage. By aligning and meeting UK regulatory requirements, this provides confidence that the RR SMR arrangements and design will also be compliant with key international regulations, as UK regulations typically originate from European Union (EU) or international regulations. The key applicable regulations, codes and standards are summarised in Table 31.1-1.

Table 31.1-1: A Summary of Key Applicable UK Regulations, Codes and Standards

Applicable Chapter Section	Regulations/Codes/ Standards	Context and Requirements
31.2 Water use and Abstraction	The Water Resources Act 1991 [5]	Water abstraction from controlled waters is regulated. A licence is required from the regulators to impound water or abstract over 20 m^3 per day of water from a river or stream, reservoir, lake or pond, canal, spring, underground source or estuary, bay or arm of the sea. Abstraction licensing is a site-specific issue.
	The Eels (England and Wales) Regulations 2009 [6]	This regulation requires the operator of an abstraction or water diversion of more than 20 m^3 per day, or any discharge to a channel, bed or sea (out to six nautical miles) to screen it to prevent the entrainment of eels. It is an offence not to have a screen on any such intake or outfall unless the Environment Agency (EA)/Natural Resources Wales (NRW) has specifically issued notice to exempt the requirement.
	Salmon and Freshwater Fisheries Act 1975 [7]	The EA/NRW can require the provision of fish passes and screens for the protection of salmon and migratory trout.
31.3 Discharges to Surface Water	Environmental Permitting Regulations 2016 (EPR2016) [8]	Discharges of trade effluent (which encompasses both radioactive and non-radioactive effluents generated at the generic site) to controlled waters (which include coastal waters out to the territorial limit) require a permit under EPR2016.

Applicable Chapter Section	Regulations/Codes/ Standards	Context and Requirements
31.5 Operation of Installations (Combustion Plant and Incinerators)	EPR2016 [8]	Combustion plants above 20 mega Watt thermal (MW_{th}) require a Part B Environmental Permit under EPR2016. Installations that require a permit under EPR2016 must justify their decisions through applying best available techniques (BAT). The permit applies conditions to the operation, maintenance, monitoring and operational controls of the combustion activity (CA). It also specifies emission limits which may include nitrogen oxides (NO_X), sulphur oxides (SO_X) and particulate matter (PM).
	Greenhouse Gas Emissions Trading Scheme Regulations 2012 [9]	Combustion plants over 20 MW_{th} in the EU require a greenhouse gas emissions (GHGE) permit. This requires the combustion plant operators' compliance with the EU Emissions Trading Scheme (EU ETS). Requires operators of a qualifying plant to register for a 'greenhouse gas permit' and establish management arrangements to ensure records of engine running and fuel use are kept and reported to the regulators.
	Greenhouse Gas Emissions Trading Scheme Order 2020 [10]	Same as above but established the UK Emissions Trading Scheme (UK ETS). The UK ETS replaced the UK's participation in the EU ETS in January 2021.
31.6 COMAH	COMAH Regulations 2015 [11]	Applies to establishments that store or use quantities of named or generic categories of dangerous substances above specified qualifying thresholds. If the facility stores or uses more than the lower threshold for a dangerous substance it is classed as a lower tier establishment. If it stores or uses more than the higher threshold it is an upper tier establishment. The COMAH regulations cover both mixed and pure substances as classified in accordance with the Classification, Labelling and Packaging (CLP) Regulation and wastes with major accident potential. The COMAH regulations do not cover radioactive materials.

Applicable Chapter Section	Regulations/Codes/ Standards	Context and Requirements
31.7 **Fluorinated Greenhouse Gases and Ozone Depleting Substances**	Fluorinated Greenhouse Gases Regulations 2015 [12] (Supported by UK regulatory guidance 2024 [13])	Fluorinated greenhouse gases include: • Hydrofluorocarbons (HFCs) • Perfluorocarbons (PFCs) • Sulphur hexafluoride (SF_6) Measures should be taken to minimise the use of fluorinated greenhouse gases. Additionally, there is a requirement to record and report fluorinated gases (e.g. quantities of gases in an equipment). Newly updated in 2022, the new changes implement higher ambition, compliance with the Montreal Protocol, greater enforcement and implementation, and more comprehensive monitoring. Users of fluorinated gas will need to: • Have qualifications and company certification to work with fluorinated gases. • Maintain and check relevant equipment using fluorinated gases for leaks. • Record fluorinated gases within relevant equipment. • Recover, reclaim or recycle fluorinated gases. • Follow rules for operating and servicing high voltage switchgear that contains SF_6.

31.2 Water Use and Abstraction

31.2.1 Regulatory Context

It is considered that demonstration of compliance with relevant UK environmental legislation, which is primarily based on EU legislation, will provide confidence to stakeholders that the RR SMR can operate in accordance with international environmental regulatory requirements.

The operation of the RR SMR cooling systems will be the major source of RR SMR water use and abstraction requirements. The cooling system will be designed and operated with due consideration to the BAT reference (BREF) document for industrial cooling systems [14].

The two main pieces of environmental legislation applicable to water abstraction in England and Wales are:

- The Water Resources Act 1991 (as amended) [5]
- The Eels (England and Wales) Regulations 2009 [6].

Water abstraction from controlled waters is currently regulated under the Water Resources Act 1991 Part II, Chapter II, and the Water Resources (Abstraction & Impounding) Regulations 2006 [15]. A licence is required from the regulators to impound water or to abstract over 20 m^3 per day of water from a river or stream, reservoir, lake or pond, canal, spring, underground source or estuary, bay or arm of the sea. Abstraction licensing is a site-specific issue.

Abstraction from the open sea does not require a licence although the proposed scheme must give due consideration to the potential impact on fish, particularly with regard to the Eels Regulations.

The UK Government intends to move the regulation of abstraction and impoundment of water from the Water Resources Act 1991 into the EPR2016 [8] regime. After the move has taken place, permits instead of licences will be granted for the abstraction and impoundment of water [16].

The Eels (England and Wales) Regulations 2009 [6] implement European Commission (EC) Council Regulation (1100/2007) (the EC Eel Regulation) (Eels Regulations) [17]. This regulation requires the operator of an abstraction or water diversion of more than 20 m^3 per day, or any discharge to a channel, bed or sea (out to six nautical miles) to screen it to prevent the entrainment of eels. It is an offence not to have a screen on any such intake or outfall unless the EA/NRW has specifically issued notice to exempt the requirement.

In addition, the EA/NRW can require the provision of fish passes and screens for the protection of salmon and migratory trout (sea trout or sewin) under the Salmon and Freshwater Fisheries Act 1975 [7].

Further relevant legislation is captured within the Water Use and Abstraction Topic Report (Reference [18]).

31.2.2 Rolls-Royce Small Modular Reactor Water Use

The RR SMR is being developed to operate on a wide range of sites, through adaption and optimisation of a single design where such sites potentially include the categories of coastal, estuarine, riverine, lakeshore sites, and inland sites without a ready supply of cooling water. However, for the purposes of the generic design, the RR SMR will operate at a coastal site and use indirect cooling.

The Cooling Water Island (CWI) [C01] provides the primary means of removing waste heat from the power station and is made up of the following systems:

- Main Cooling Water System (MCWS) [PA], which uses seawater and provides cooling for the main turbine condenser.
- Auxiliary Cooling and Make-up System (ACMS) [PE], which uses seawater, provides cooling to the Turbine Island (TI) [T01] Closed Cooling Water System (TI-CCWS) [PG] and make-up and blowdown to the MCWS [PA].
- Essential Service Water System (ESWS) [PB], a separate system that uses potable water and provides cooling to systems within the Reactor Island (RI) [R01].

The MCWS [PA] design is based upon indirect cooling via mechanical draught cooling towers (MDCTs) as this arrangement can be deployed on a greater range of sites than would be possible when using direct cooling, which would otherwise be limited to large water sources. The indirect cooling system using MDCTs was selected following an optioneering process [19] which addressed a range of factors for direct and indirect cooling including operability, environmental impact, programme, and cost.

As the RR SMR is also compatible with direct cooling and closed cooling, site-specific requirements may lead to a change in final design, such as at coastal sites for example, as direct cooling may represent BAT. Therefore, Rolls-Royce SMR Limited has not foreclosed decisions on other cooling systems made during the design stage. However, to reiterate, the generic design that is currently being assessed within the GDA uses indirect cooling and is located at a coastal site.

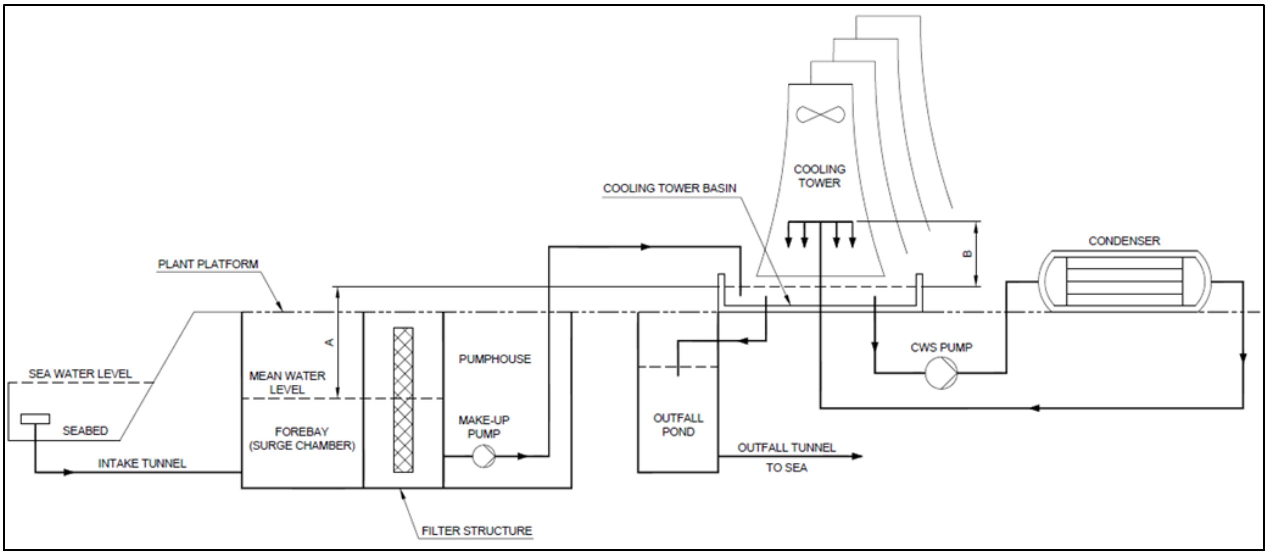

Figure 31.2-1: Indirect Cooling System Schematic

The normal seawater abstraction rate for indirect cooling is anticipated to be 4752 m^3/h (1.3 m^3/s) into the ACMS [PE] [18]. In deployment locations away from the coast, freshwater can be used and abstraction quantities are likely to be lower than those required for the equivalent seawater cooling systems. However, it is likely that freshwater abstraction will exceed 20 m^3/day and, if so, will require an abstraction license under the Water Resources Act 1991 [5].

31.2.3 Other Water Requirements

Potable water is supplied through the Plant Potable Water System [GA], which feeds the rest of the power station. Other water requirements include:

- Demineralisation Plant [GC]
- Firewater System [XGA]
- ESWS [PB] Cooling Tower Make-up [PBR]
- General services water supply (cleaning etc.).

Potable water use is anticipated to be 43 m^3/h, however exact values will vary based on a number of aspects, including weather, number of personnel present on site and more [18]. It is assumed that the generic site has a towns water connection which supplies potable water quality to the site, as such there is no need for freshwater abstraction from surface or groundwater supplies. It is not envisaged that potable water supply will be further considered during generic design but will be an area of consideration during site-specific design.

31.2.4 Water Use Efficiency

Water recovery and re-use has been considered in the design of the RR SMR's effluent collection and treatment system. Effluents will be segregated in order to optimise their treatment and maximise the potential for water re-use.

Two of the most volumetrically significant effluents produced during normal operations are the ESWS cooling tower blowdown, and effluent produced during the demineralised water production process. The Wastewater Drainage and Treatment System [GM] treats and recycles these effluents for re-use within the ESWS system or the demineralisation system. This will reduce the potable water demand of the site, and simultaneously reduce volumes discharged. The Wastewater Drainage and Treatment System [GM] will also employ mobile wastewater treatment plants to treat and recycle effluents during an outage.

Other water re-use/minimisation options which have been implemented within the design include [18]:

- Siting of equipment (heat exchangers) to minimise pipe runs and reduce the quantity of water stored within cooling systems.
- Use of chemical addition systems (including Corrosion Inhibitors [PUT], Scale Inhibitors [PUQ], and Biocide and Bio-Dispersants [PUL]) to protect the cooling system and keep heat exchange surfaces clean and free of deposits or bio-films. This enables maximum cycles of concentration to be achieved, such that the cooling system can be operated at peak efficiency both in terms of water use and energy use.

- Use of potable water for ESWS provides a lower and less variable heat sink temperature and ESWS blowdown is treated and recycled as ESWS make-up water.

- Inclusion of a recirculation line to recirculate blowdown for use at the forebay to reduce frazil ice build-up. The level of recirculation would be increased in colder conditions due to the reduced evaporative losses and resulting salt concentration meaning greater amount of reuse.

Within the TI, the Condensate System [LC] has been designed to recirculate cooled and clean condensate into the main condenser hotwells and feedwater preheaters for re-use [20].

Sustainable water use options to support greater resource efficiency, such as rainwater capture and re-use, are being considered and will be developed further at a later stage. Current design opportunities involve the Surface Water Drainage System [ZZT] and the introduction of a sustainable drainage system that aims to collect surface water and transfer the flows to the CWI with further potential for attenuation [21]. Further work is also being carried out to determine whether rainwater from the RR SMR roofs can be recycled and utilised as make-up to the ESWS cooling towers with the intention of further reducing the amount of potable water used on site [21].

Further work will be carried out, as the design progresses and during site-specific stages, to quantify water re-use and identify further opportunities for water minimisation, re-use and recycling.

The following forward actions (FA) are captured in Table 31.8-2:

- **FA 31.1:** Development of a sustainable water strategy, such as rainwater harvesting and recycling.

- **FA 31.2:** Understand the impacts of recirculating blowdown on marine life.

31.2.5 Water Abstraction

As the baseline design is for a coastal site, it is assumed that seawater will be abstracted and discharged using the ACMS [PE] for the MCWS [PA]. This is assumed to be via a tunnel that will be designed specifically for the site. The baseline design assumes the cooling water will be abstracted through a 1.7 km long, 1 m diameter intake tunnel, that extends 1.6 km offshore, to feed the make-up water system (required to compensate for the evaporated water from the cooling tower and limit the concentration of solid materials in the system) [22]. The intake of the tunnel will be developed using BAT design principles but is currently assumed to be a low velocity intake in a low marine life area and will have guard screens to exclude large debris with finer fish and debris screens utilised in the onshore forebay.

The design features of the abstraction system will be developed further on a site-specific basis to, as far as possible, minimise its environmental impact. This will include consideration of:

- Physical barriers and behavioural barriers, such as a bar screen.

- The design of the inlet structure to minimise intake velocities (to allow fish to escape entrainment).

- The location of the inlet structure (to avoid particularly sensitive areas such as fish nurseries).

- The design of the inlet structure to minimise impact to any marine life.

It should be noted that the above list is not exhaustive, and the details of relevant issues can only be determined during the site permitting phase. However, the current design has identified preferences of the abstraction system regarding marine life. These preferences are as follows [18]:

- Preferred intake design is an offshore seabed intake using a low-velocity side entry (LVSE) intake with a vertical bar screen.
    - The side entry intake will be parallel to the predominant wave direction and sized to reduce water velocity around the entrance. Designing with a side entry also further prevents entrainment and makes it easier to remove detritus and captured marine life.
    - The intake is positioned at -18 m mean sea level (MSL) to reduce the effects on waveforms and water flow in order to prevent the formation of vortices.
    - Large intake heads can result in the formation of an artificial reef, which can lead to changes in light levels and water conditions with the potential of causing species to move.
- Seabed scouring impacts are reduced by positioning a scour pad around the intake to reduce the effects of water turbulence causing disturbance to sediments and associated marine life.
- No additional measures in the generic site baseline for a physical deterrent as the cooling water intake head will incorporate a bar screen to prevent entry of fish, and it will be designed to allow a low velocity intake flow to prevent species becoming impinged on the bars.
- No additional measures for physical deterrents are recommended for a generic site baseline as common solutions are unlikely to be applicable for all sites as different systems are suited to deterring specific species of marine life only.
- A trash rake is primarily used on sites that are at risk of crabs entering the cooling water intake and could be used. Such marine species will pass through the trash rake and will be caught by the fine filtration system within the filtration channels.
- Preferred system for fish recovery from the trash rake is the use of a low pressure spray (<1 bar) installed within the trash rake to push the species off and into a fish return flume.
- The preferred debris recovery and collection system will be a debris flume that will lead into a basket for conventional waste removal.
- The preferred fish return line shall use pipework, and a collection flume will be used to collect marine species from the filtration system. Pipework will be provided for the fish return line to provide protection of the marine life from predation and reduce other environmental hazards such as biofouling.

It should be noted that these designs are preferences and do not foreclose other options that may be more suitable or represent BAT when site-specific assessments are undertaken.

31.3 Discharges to Surface Water

31.3.1 Regulatory Context

As previously noted, demonstration of compliance with relevant UK environmental legislation, which is primarily based on EU legislation, will also demonstrate that the RR SMR can operate in accordance with international environmental regulatory requirements.

Where required, liquid effluents will undergo treatment prior to discharge to surface waters. Where appropriate. the design of these treatment systems will give due consideration to all applicable EC BREF and BAT conclusion recommendations, including the EU BREF document on waste treatment [23], which covers techniques for the prevention and control of emissions to water and physico-chemical and/or biological treatment of water-based liquid waste.

Discharges of trade effluent (which encompasses both radioactive and non-radioactive effluents generated at the generic site) to controlled waters (which include coastal waters out to the territorial limit) require a permit under the EPR2016 (Statutory instruments 2016 No.1154), as amended [8]. Application for the permit will necessitate the provision of information on the source of the effluent, its flow rate, contaminants present, thermal load, and assessment of the impact of the releases on the receiving environment.

31.3.2 Effluent Sources and Characteristics

Various packages of work have been undertaken to enhance the understanding of the RR SMR liquid effluents and their characteristics, including the suite of High Level Water Balance documents [24], [25] and the Liquid Effluent Environmental Discharge reports [26], [21].

Further work is being undertaken to understand conventional characteristics of liquid effluents, including dosing chemicals, to be discharged to the environment to enable incorporation of BAT into the design of the RR SMR. Deliverables to support this understanding include:

- The Water Mass Balance Phase 1 (Q3 2024) and 2 (Q4 2024)
- The Thermal and Chemical Discharges Reports (Q1 2025).

The focus of this section is on the various conventional liquid waste streams that arise across the RR SMR and would be discharged to the environment via the Cooling Water Outfall Pond [UPK] (see Figure 31.3-1). Further detail on Figure 31.3-1 can be found within the liquid effluent environmental discharge process flow diagram (Reference [27]).

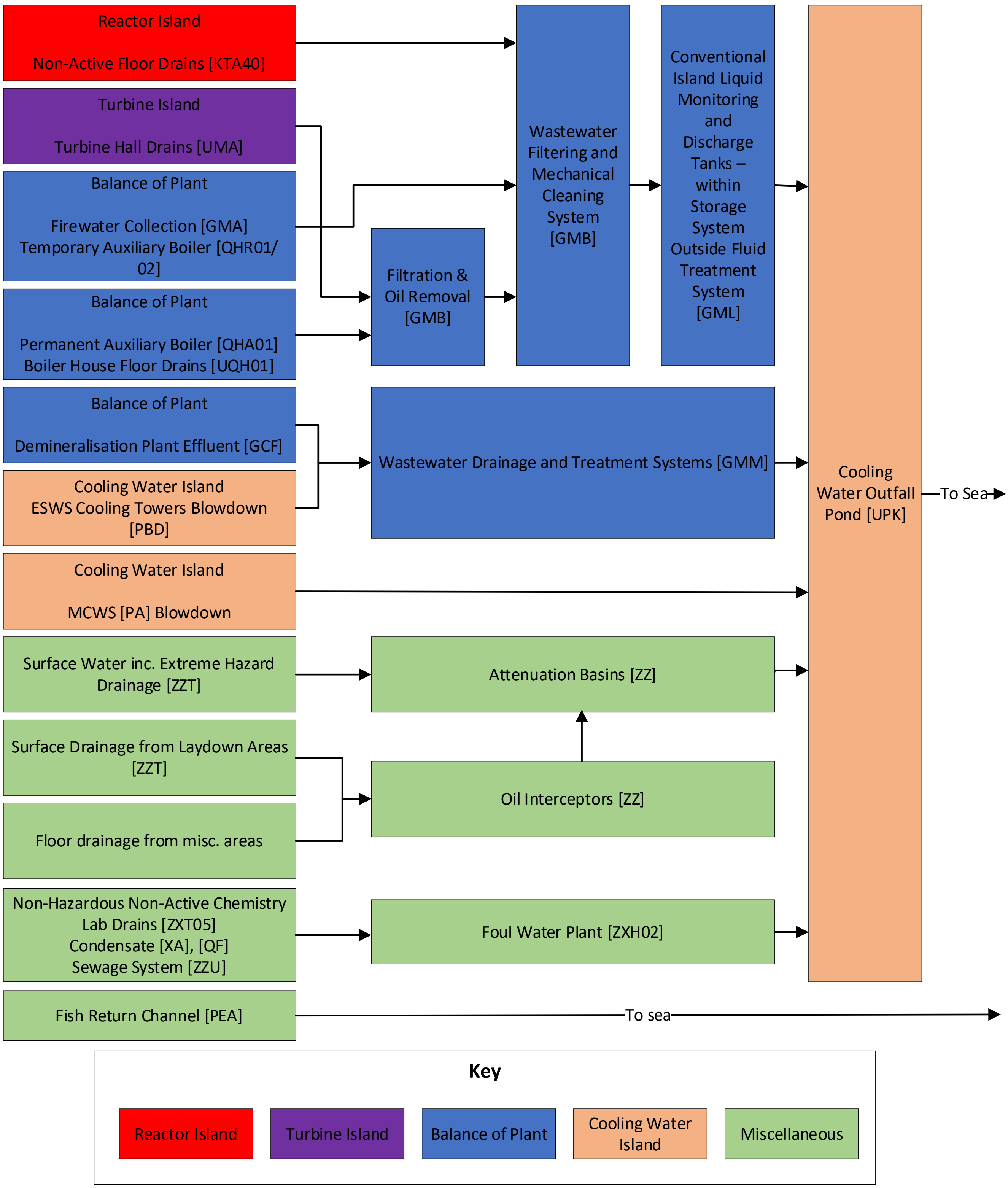

Figure 31.3-1: Simplified Liquid Effluent Sources to the Sea [27], [28]

Conventional liquid effluent drains will arise from the following sources:

- RI (collected via balance of plant, BOP [B01]):
    - RI Non-Active Floor Drains Tanks [KTA40]
- BOP:
    - Conventional island liquid monitoring and discharge system:
        - Firewater Collection System [GMA]
        - Temporary Auxiliary Steam Boiler [QHR01/02]
        - Permanent Auxiliary Steam Boiler [QHA01]
        - Boiler House [UQH01] floor drains
    - Wastewater Treatment Systems [GMM]
        - Concentrate from effluent produced during demineralised water production process (mixed with ESWS cooling tower blowdown)
- CWI:
    - ESWS [PB] cooling tower blowdown (routed for treatment in [GMM] in BOP)
    - Blowdown from the MCWS cooling tower basins
- TI (collected via BOP):
    - TI floor and maintenance drains
    - Steam Generator Blowdown System [LCQ] (normally no flow)[1]
- Conventionally uncontaminated floor drain systems
    - Any effluent found to be conventionally contaminated, so not suitable for discharge to the environment, is collected locally via sumps (or similar) for direct off-site disposal via road-tanker or similar
- Non-active condensate systems
    - Non-Hazardous Non-Active Chemistry Laboratory [ZXT05] drains

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[1] The Steam Generator Blowdown [LCQ] system collects blowdown from the secondary circuit of all three steam generators (SG) and treats it for re-use in the secondary circuit via a single purification system (utilising ion exchange columns, with pre-filtration and post filtration). It is not certain yet whether this system will discharge to the Cooling Water Outfall Pond [UPK] via the [GM] system or directly, and a FA has been captured in the E3S Case Version 2, Tier 1, Chapter 28: Sampling and Monitoring Arrangements [31] to confirm the routing of this effluent.

- Non-Nuclear Ventilation and Air Conditioning System [XA] condensates
- Central Control Air Supply System [QF] condensates

- Surface Water Drainage System (including extreme hazard) [ZZT]
- Sewage System [ZZU]
  - Welfare facilities.

Additionally, to the above, there will be other sources of conventional liquid waste that would need to be managed but would not be discharged to the environment via the Cooling Water Outfall Pond [UPK] such as spills (hydrocarbon/chemicals). Every effort would be made through the design and operating techniques to avoid such occurrences, but once occurred these waste streams would be collected and transported offsite for further treatment and/or recycle or disposal.

Contaminants:

All effluents discharged to surface water will have the potential to contain conventional contaminants, and the RR SMR has thus been developed to ensure that effluents will be collected and transferred for treatment in a manner which will optimise their treatment and allow for re-use where practicable. All effluents discharged to surface water will have been subject to treatment, where required, to prevent significant adverse effects on the environment and comply with future environmental permit conditions. As the design matures, details on SSCs to prevent the release of polluting substances will be identified.

Table 31.3-1: Potential Conventional Contaminants of Routine Aqueous Effluents Discharged via Outfall

Effluent	Potential Conventional Contaminants Upon Arising	Discharge Rate into Outfall
BOP (Also including sum of effluents from other islands that are sent to BOP, minus permeate of the wastewater treatment system which is recycled to ESWS)	May contain: • Treatment plant concentrates – Minerals from towns water • Process treatment additions including corrosion inhibitors (nitrites and molybdate) • Secondary circuit additions (ammonia, hydrazine) and SG blowdown • Any auxiliary boiler treatment chemicals (amount and type of treatments required to be determined, TBD) • Possible detergents from floor washings • Lubrication oils and greases • Suspended and dissolved solids	Average of 3 m^3/s, maximum of 47 m^3/s [29]

Effluent	Potential Conventional Contaminants Upon Arising	Discharge Rate into Outfall
CWI	• Concentrated salts and contaminants present in incoming in seawater • Biocide (sodium hypochlorite) and chlorinated byproducts • Corrosion inhibitor • Scale inhibitor • pH control (if required to inject into cooling water. Dosed in line with RGP and BAT, but will be decided at a site-specific level) • Flocculant (if required to inject into cooling water. Dosed in line with RGP and BAT, but will be decided at a site-specific level) • Heat (the outfall pond enables effluent from different sources to mix so temperature and chemical composition can be balanced before discharging to the external environment via the outfall) • Suspended and dissolved solids	Average of 0.85 m^3/s, Peak 0.92 m^3/s [29]
Sewage drainage system	• Suspended and dissolved solids • Phosphorus • Ammonia • Metals • Organic matter • Chemical oxygen demand • Biochemical oxygen demand	$<0.01 m^3/s$ [29]

Effluent	Potential Conventional Contaminants Upon Arising	Discharge Rate into Outfall
Surface water drainage system/extreme hazard drainage system	• Suspended and dissolved solids • Oils and lubricants • The proposal is that site drainage will be segregated from potential contamination sources through the conventionally uncontaminated floor drains systems, sampled via on-line and operator sample monitoring and discharged to surface water as uncontaminated surface drainage if the effluent is within the site's discharge permit [30] • Site run-off is assumed ultimately to be discharged through the cooling water return - Potential for oils and greases from hard-standing land, car parks or roof areas will be removed via oil separators [21]	For surface water drainage system: Typical operation of 0.08 m^3/s, maximum of 2.3 m^3/s [24]

31.3.3 Management of Effluents and Contaminants

Wastewater Filtering and Mechanical Cleaning System [GMB]

The Wastewater Filtering and Mechanical Cleaning System [GMB] is part of the conventional island liquid monitoring and discharge system (CI-LMDS) and removes suspended solids and oil. Sources of suspended solids are limited to solids and dusts that may enter floor drains systems via sumps. Suspended solids will be removed via the Wastewater Filtering and Mechanical Cleaning System [GMB] to a level as low as reasonably practicable (ALARP). Oil removed via the Wastewater Filtering and Mechanical Cleaning System [GMB] will be disposed of off-site.

The Storage System Outside Fluid Treatment System [GML] (also part of the CI-LMDS) stores trade effluent routed through the Wastewater Filtering and Mechanical Cleaning System [GMB] to allow for settling and characterisation of the effluent. Upon characterisation, effluent that can discharged within the site discharge permit is discharged into the Cooling Water Outfall Pond [UPK] and that which cannot be discharged will be sent for off-site disposal.

Sump drains buffer tanks will collect effluent from the Wastewater Filtering and Mechanical Cleaning System [GMB]. The buffer tanks allow for a three-phase settlement of oil, water and solids. Oils and solids will be removed, collected locally and disposed of off-site. However, due to the treatment from the Wastewater Filtering and Mechanical Cleaning System [GMB], it is unlikely for solids and oils to be present within the tanks [30].

Table 31.3-2 below presents specific oil sources and systems that are collected by the Wastewater Drainage and Treatment System [GM].

Table 31.3-2: Oil Containing Systems [30]

Effluent Source System(s)	Source Island	GM Processing System	Source description
Turbine Hall [UMA] floor drains	TI	Conventional island liquid monitoring and discharge system	Turbine Hall [UMA] includes a series of equipment, such as the turbines, which require lubricants, oils and grease. Non-active effluent, including oil, may leak onto the floor from leakages and maintenance and enter the Turbine Hall [UMA] floor drains system.
Permanent Auxiliary Steam Boiler System [QHA] Boiler House [UQH01] floor drains	BOP	Conventional island liquid monitoring and discharge system	It is likely that the Boiler House [UQH01] will contain equipment that requires lubricants, oils, and grease. Non-active effluent, including oil, may leak onto the floor from leakages and maintenance and enter the Boiler House [UQH01] floor drains system.
Mechanical Workshop [Z01 ZXT03] floor drains Make-up Pumphouse [U03 UPF19] floor drains Main Circulation Pumphouse [U03 UPC] floor drains Domestic Water Pumphouse [Z01 ZXL01] floor drains Fire Protection Building [Z01 ZXG01] floor drains	N/A – Miscellaneous buildings	Conventionally uncontaminated floor drains systems	These miscellaneous buildings are likely to contain pumps or mechanical equipment that may require lubricants, oils and grease. Non-active effluent, including oil, may leak onto the floor from leakages and maintenance and enter the specific building floor drains.
Outdoor secondary containment bunds (TBD) Structures and areas for Electrical Grid and Distribution System [U05 UA] (Transformer bunds)	N/A - Miscellaneous outdoor structures	Conventionally uncontaminated floor drains systems	These miscellaneous outdoor structures are likely to contain pumps or mechanical equipment that may require lubricants, oils and grease. Non-active effluent, including oil, may leak onto the floor from leakages and maintenance and enter the specific bunds.

The Boiler House [UQH01] and Turbine Hall [UMA] sumps will include local oil removal oil-skimmers. The Central Drains System [GMA] will also have an oil-removal stage, yet the specification of the separator is yet to be developed. It is anticipated that it will be a class 1 oil-water separator that will achieve a maximum permeate oil load of 5 mg/L [30].

Wastewater Drainage and Treatment Systems [GMM]

The wastewater treatment system permits the treatment of ESWS cooling-tower blowdown (CTBD) and demineralisation plant effluent. This incorporates Wastewater Treatment Systems [GMM] to produce both ESWS make-up and demineralisation plant feed.

Oil Interceptors

Oil-water separators (within the scope of the Wastewater Filtering and Mechanical Cleaning System [GMB]) are provided where all conventionally uncontaminated floor drains systems sumps interface with the Surface Water Drainage System [ZZT]. Note that in the event of contamination beyond a pre-determined limit, effluent will be sent for off-site disposal, rather than to the Surface Water Drainage System [ZZT].

Foul Water Treatment Plant [ZXH02]

The treatment technology is currently unknown; however, this is anticipated to be a commercial off the shelf (COTS) treatment plant package. This will treat the municipal effluent to produce an effluent suitable for discharge into the Cooling Water Outfall Pond [UPK]. The treatment process is anticipated to also produce a concentrated sludge which may require periodic off-site disposal.

Table 31.3-3 summarises the effluents routed via each of the treatment systems outlined above.

Table 31.3-3: Effluents Routed Via the Treatment Systems

Treatment System	Effluent sources treated/abated
Wastewater Filtering and Mechanical Cleaning System [GMB] and Storage System Outside Fluid Treatment System [GML]	• RI Non-Active Floor Drains Tanks [KTA40] • Firewater Collection [GMA] • Temporary Auxiliary Boiler [QHR01/02] blowdown • Permanent Auxiliary Boiler [QHA01] blowdown • Boiler House [UQH01] floor drains • Turbine Hall [UMA] drains
Wastewater Treatment Systems [GMM]	• Demineralisation Plant Effluent [GCF] • ESWS Cooling Towers Blowdown [PDB]

Treatment System	Effluent sources treated/abated
Oil Interceptors [ZZ]	• Surface Drainage from Laydown Areas [ZZT] • Floor drainage from miscellaneous areas
Foul Water Treatment Plant [ZXH02]	• Sewage System [ZZU] • Central Control Air Supply System [QF] condensate • Non-Nuclear Ventilation and Air Conditioning System [XA] condensate • Non-Hazardous Non-Active Chemical Laboratory Drains [ZXT05]

Further work:

The effluent streams arising from the RR SMR for discharge to the environment will be characterised more fully as the design progresses with information developed to include details of effluent volumes, sources, the contaminants present and their concentrations, and justification for the selection of chemical additions (e.g. biocides and corrosion inhibitors). The outline information currently available on conventional aqueous effluent arising from normal operations for discharges via the outfall is shown in Table 31.3-1.

The sampling and monitoring of the in-process and final discharge streams is on-going work, as described in E3S Case Version 2, Tier 1, Chapter 28: Sampling and Monitoring Arrangements [31]. This is due to the Auxiliary Non-Nuclear Sampling System [QU] that covers the Cooling Water Outfall Pond [UPK] sampling being currently in development and thus no decisions have been established, apart from the baseline scenario described in E3S Case Version 2, Tier 1, Chapter 28: Sampling and Monitoring Arrangements [31] and the Liquid Effluent Sampling and Monitoring Philosophy [28].

31.3.4 Effluent Discharge

The largest source of effluent discharge is associated with the ACMS. The current design baseline within the ACMS is to use sodium hypochlorite as a biocide which will be dosed in the make-up water, after fish removal measures and in the cooling tower basin. The biocide dose will be aligned with ALARP and BAT on a site-specific basis to minimise environmental impact [21]. Scale and corrosion inhibitors will be site specific but are assumed to be bespoke polymer blends.

The outfall structure will be designed to diffuse the discharges to ensure mixing and minimise the thermal plume as far as is reasonably practicable, with site specific abatement methods used to minimise the environmental impact of discharges.

Table 31.3-4: Outfall Tunnel Flow Rates

Flow	Approximate Flow Rate (m^3/s)	Source Data
ACMS [PE] Discharge comprising: • MCWS [PA] blowdown water • Wastewater Drainage and Treatment System [GM] • Liquid Radioactive Effluent Process System [KN]	• Average [PA] blowdown 0.84, maximum 0.92 • Maximum [GM] 0.01 • Maximum [KN] 0.01	Liquid Effluent Environmental Discharges – Heat & Material Balance [26]
Stormwater	Maximum 2.3 (normal operation <0.1)	
Treated sewage	Estimated at <0.01	

[1] It should be noted that [KN] is anticipated to be discharged approximately every 18 months, whereas [PA] is anticipated to be daily. Further information on these systems is captured within E3S Case Version 2, Tier 1, Chapter 28: Sampling and Monitoring Arrangements [31].

The outfall diffusion structure will be site-specific but is assumed to be located at -6 m MSL to ensure that the outlet will remain submerged during all tidal conditions. The intake and outfall will be sited such that there is no recirculation effect between the intake and outfall flows. Separation distances are inherently site-specific and will be confirmed via modelling during detailed design.

31.3.5 Options for the Beneficial Use of Waste Heat

Cooling water circulating through the condenser is used to condense the steam passing through the turbines. In the RR SMR the heat transferred to the circulating water in the condenser (termed “waste heat”) is then discharged to the atmosphere via evaporation in the cooling towers.

There is the potential to take heat from the condenser outlet and supply it for beneficial and more sustainable uses which can particularly contribute towards developing sustainable communities local to RR SMR sites. Such opportunities could include:

- Crop growing (e.g. heating greenhouses)
- Aquaculture (fish farming) facilities
- Desalination.

Options for the beneficial re-use of waste heat will primarily be identified at site specific stage. However, opportunities will be identified as the design matures and more information becomes available on characteristics of waste heat e.g. temperature and volumes opportunities for reuse will be considered.

Viable options will depend on the amount and grade of waste heat available, as well as the proximity and demand from local heat users. Whilst the selection of options for beneficial use of waste heat is highly site-specific, options have been considered in the design to date and can be accommodated through minor alteration of the system architecture. Beneficial use of re-heat will thus be addressed more fully at the site-specific stage.

31.3.6 Summary of Proposed Assessments

More detail will be provided on the following topics as the RR SMR design progresses:

- Effluent sources for conventional discharges
- Potential uses for waste heat
- Design of the effluent collection and treatment systems together with supporting BAT assessments
- Characterisation of discharges from the effluent treatment systems and direct discharge (e.g. the MCWS [PA] blowdowns), highlighting the likely presence of any priority substances
- Controls on non-conforming effluents and transfers between collection systems
- Controls in the event of detection of unplanned contamination of discharges
- The proposed thermal uplift of ACMS [PE] discharges
- An assessment of the environmental impact for the discharge of each individual effluent stream.

It is envisaged that the approach to assessing the environmental impacts arising from the discharge of chemical loads will be based on the use of the EA and Department for Environment, Food and Rural Affairs (DEFRA) Surface Water Pollution Risk Assessment for Environmental Permits [32] at the generic site.

Assessing the environmental impact of the thermal plume generated by the cooling water discharge will require the use of complex computational modelling and detailed information on the characteristics of the receiving water body, supported by local monitoring data from the development site. Initial thermal modelling has been conducted at a high-level, however as the assessment of the impact of thermal dispersion is site-specific the thermal impact of discharges will be assessed in detail at the site-specific permitting stage. This will be captured in further detail within the future Thermal and Chemical Discharges Report.

Preliminary options for the beneficial use of the RR SMR's waste heat will be identified at a later stage in the generic design phase.

31.4 Discharges to Groundwater

31.4.1 Current Status

There are no planned discharges to groundwater from the RR SMR.

31.4.2 Regulatory Context

The measures that demonstrate BAT used to prevent accidental leaks and spills of non-radioactive pollutants that could give rise to accidental pollution of land and groundwater will be identified. Consideration will be given to RGP and industry guidance on secondary and tertiary containment systems, for example the Construction Industry Research and Information Association (CIRIA) guidance C736 [33]. Measures to prevent accidental leaks and spills of pollutants to groundwater will include physical and management measures and will be formally recognised as EPMs.

31.4.3 Summary of Proposed Assessments

Throughout the design process, the measures that demonstrate BAT used to prevent accidental leaks and spills of non-radioactive pollutants which could give rise to accidental pollution of land and groundwater will be formally identified. These will include:

- Avoidance and minimisation of chemicals and oils stored on site in the first instance.
- Physical measures, such as primary, secondary and tertiary containment of potentially polluting materials (e.g. chemicals and oils), and the use of interceptors.
- Management measures such as staff training and examination, maintenance, inspection and testing (EMIT) procedures.

31.5 Operation of Installations (Combustion Plant and Incinerators)

31.5.1 Current Status

The RR SMR does not include an on-site incinerator.

The current design intent is that the RR SMR will raise auxiliary steam through the Auxiliary Steam Generating and Supply System [QH] via a hybrid of one permanent electric boiler and two mobile fired boilers (MFB) (fuel source TBD but assumed to be either hydrogenated vegetable oil, HVO, or low-sulphur diesel).

Six diesel generators (DG) of differing sizes will be used to provide emergency AC power to electrical systems when the main power supply is unavailable, such as during a loss of offsite power (LOOP) event.

The following subsystems that require a standby or alternate power supply during a LOOP are:

- **[BD]** – High Voltage Essential Electrical AC Standby Supply System. Total aggregated electrical power requirement of 4 mega Watt electric (MW_e).
- **[BK]** – Low Voltage Essential Electrical AC Standby Supply System. Total aggregated electrical power requirement of 2 MW_e.
- **[BL]** – Low Voltage Alternate Electrical AC Standby Supply System. Total aggregated electrical power requirement of 0.2 MW_e.

Table 31.5-1 below presents the thermal inputs per CA installation [34].

Table 31.5-1: Thermal Inputs per CA Installation

CA Type	Thermal Input (MW_{th})	Number of Installations	Total Thermal Input (MW_{th})
MFB	6.5	2	13
[BL] DG	0.3	2	0.6
[BK] DG	3	2	6
[BD] DG	6	2	12

MFBs are more suitable and preferable for using alternative fuels as they are mobile and not permanent additions, and as they do not serve a nuclear safety function. This also allows for other alternative/emerging technologies with smaller environmental impacts to easily replace these when advanced sufficiently and once deemed safe to use. DGs on the other hand must fulfil the following non-functional performance requirements (NFPR) and non-functional system requirements (NFSR) within the [BD] system [34]:

- Function: The technology must generate AC electrical power from a stored energy source, at a voltage suitable for the connected system

- NFPR 1: Must have high reliability
- NFPR 2: Must have a fast start-up time to 100 % load
- NFPR 3: Must be suitable for continuous operation at 100 % load for a duration of >72 hours
- NFSR 1: Must be applicable for a Class 2 safety function of SSC as defined by the Office for Nuclear Regulation (ONR) [35]
- NFSR 2: Must be independent from off-site systems
- NFSR 3: Must withstand seismic events.

These functional requirements limit the opportunity at this stage in the design to utilise biodiesels or HVOs within the DGs as these have been reported to impact reliability and performance of DGs through fuel degradation, sedimentation and bacterial growth (Note that these justifications for choosing DGs are likely to also be applicable to the [BK] and [BL] subsystems though they have lower safety classifications) [34]. Low-sulphur diesel is however preferable within DGs as it reduces sulphur dioxide (SO_2) emissions, yet this does not foreclose opportunities to explore technological advancements in alternative energy sources or lower carbon fuels in the future. There is greater opportunity to explore alternatives to support the [BK] and [BL] systems due to their lower safety class compared to [BD], however at this stage they are assumed to be supported by DGs. The CA Topic Report [34] provides further detail and optioneering on the MFBs and the DGs, including a description of relevant RGP and operational experience (OPEX) and BAT assessment.

The current assumption is that the MFBs will use either HVO or low-sulphur diesel, operate for approximately 3-5 days (approximately 120 hours) every 18 months and be a mobile plant that is removed from site when not in use. It is assumed that any maintenance, performance testing, compliance or commissioning will take place outside the RR SMR site. This aspect of the RR SMR design will be kept under review for the purposes of future permitting (see Section 31.5.2).

Batteries are likely to provide additional support to back-up power on-site. It should be noted that the BAT assessment for emergency back-up DGs and MFBs does not prevent batteries being considered in future assessments as advancements in technology could improve footprints and other considerations for emergency back-up batteries [34]. These options will be reassessed as part of the conduct design optioneering process to ensure BAT is applied.

Any additional combustion plant, not providing a nuclear safety function e.g. infrastructure associated with water management, waste treatment or fuel storage may feature in the design and will be assessed as necessary to help ensure optimised design and regulatory compliance.

31.5.2 Regulatory Context

Permitting

Within the UK or EU, the regulatory regime that would apply to any combustion plant deployed at a RR SMR will depend on the thermal input capacity of all combustion plants on the site. If diesel engines were selected for standby generation, engines with the thermal input capacity of approximately 8.5 MW_{th} would be required to provide 3 MW_e power output. This does not, however, take into account any allowance for redundancy or diversity requirements in the generating equipment, so additional generating capacity may well be required. This will be determined as the design progresses if DGs are selected.

It is expected that the RR SMR combustion plant will be below the 50 MW_{th} input threshold for a Schedule 1 Installation under EPR2016 [8]. However, the plant would likely come under the provisions of EPR2016 Schedule 25A (medium combustion plant (MCP) controls) due to their likely thermal rating of between 1 and 50 MW_{th}. As such, a MCP would be required for the 6 MW_{th} and 3 MW_{th} DGs. Provided the combustion plant are operated for the purposes of testing less than 500 hours a year no emission limit values (ELVs) would apply, although they would need to have an ERP2016 Schedule 25A MCP permit. Whilst there is no requirement to demonstrate BAT as part of the permit application for the MCP directive (MCPD) regime, all design decisions must demonstrate BAT.

If the thermal input capacity of all the combustion plant exceeds 20 MW_{th}, the plant would also require a Part B Environmental Permit under EPR2016 [8]. This regulatory requirement applies solely to controlling emissions to air (rather than to all environmental media as is the case under Part A Environmental Permits). There is specific regulatory guidance for Part B combustion plant, which is taken into consideration as RGP.

Any DGs would be expected to be excluded generators under EPR2016 Schedule 25B (specified generator controls), by virtue of a specific exclusion for emergency plant on nuclear licensed sites. This will be confirmed with the regulators during the permit application process (by the future permit holder) but would mean that the requirements of the specified generator controls would not apply.

An assessment of the effect of any combustion plant air emissions has been conducted, including identifying proposed measures to minimise their environmental impact. The assessment has included input information on stack location, surrounding building dimensions, operating modes (particularly the test running regime), and capacity of the combustion plant. A stack height calculation is likely to be required to support dispersion modelling of combustion products and help inform whether the proposed stack height(s) represent the BAT option. Stack height calculation is likely to follow, or be very similar to, Her Majesty's Inspectorate of Pollution (HMIP) D1 stack height calculation method [36], noting that the default values in the D1 method for local background and current air quality guideline value are out of date and will need to be substituted with more representative values as appropriate [37].

The assessment captured within the CA Topic Report [34] suggests that the Part B threshold of 20 MW_{th} is not met for the stationary technical unit (STU). However, under EC Guidance on Annex 1 of EU ETS [38] and EA Guidance Document RGN 2 [39], mobile plants can be considered stationary under certain conditions. For example, if it would take significant time and additional equipment to install an MFB they could get classed as an STU. Currently, it is considered that MFBs do not meet the environmental legal definitions of an STU, and they would not contribute towards the Part B permit thermal input threshold. However, this will be kept under review as the design progresses,

- **FA 31.3:** Further understand regulatory requirements and where MFBs fall under the Part B permit as STUs.

It was concluded that the use of combustion plant within the RR SMR does not significantly impact the environmental signature of the site nor is a project delivery issue. However, further work will be undertaken to expedite this permitting process as to prevent potential delays to deployment.

31.5.3 Air Quality Impact Assessment

The pollutant emissions from the operation of the MFBs and DGs vary upon the exact specification and selected fuel type. The emissions rates for the MFBs and DGs can be found within the CA Topic Report (Reference [34]). Where possible, emission rates have been based upon supplier data. Yet, where this is unavailable, ELVs for liquid fuel boilers have been used for MFBs. It has also been assumed that concentrations of pollutants are constant for each size of DG and that reductions in emission rates are dependent upon the volume flow rate of the exhaust. Furthermore, emission rates for DGs have been based on worst case scenarios at Hinkley Point C (HPC) following a LOOP event during which 8 DGs are used over 25 hours [40]. Due to this, the emission rates are conservative and actual values are likely to be significantly lower.

The EA's 'H1 screening tool' [41], which uses conservative estimates of dispersion to estimate the maximum process contribution (PC) from the emission of a pollutant, was used in this assessment. The tool determines whether the maximum PC from pollutants can be considered insignificant or not (i.e. a small fraction of the environmental assessment limits, EAL).

The pollutant emissions from the MFBs were aggregated into a single release point as the boilers are likely to be adjacent to one another. The trailer containing the MFB is approximately 5 m high with a 2 m exhaust stack fitted to the trailer, hence a 7 m release height.

The DGs were conservatively assumed to have a single release point due to the continuing evolution of the RR SMR design and so individual placements of the DGs may change over time.

The stack height for [BL] DG was conservatively set to 0 m as the exhaust stack for a DG of such small capacity would be of comparable heights to nearby buildings. This is likely to cause a greater concentration of pollutants due to entrainment by building wakes.

Further in-depth details and methodology on the assessment is found within the CA Topic Report [34]. However, to summarise the results of the assessment:

Long-term impacts from the combination of MFB and DG - indicated that impacts of PM_{10} and $PM_{2.5}$ were insignificant as they were predicted to be <1 % of the EAL. Nitrogen dioxide (NO_2) was predicted to be 15 % of the EAL, occurring at approximately 10 m from the exhaust stack. This distance is likely to still remain within the site boundary and so members of the public would not be present and EAL would likely not apply. At the site-boundary of approximately 300 m, the NO_2 was predicted to be <1 % of the EAL and so is insignificant.

Short-term impacts of both MFB – impacts of CO, SO_2 and PM_{10} were considered to be insignificant as they were <10 % of the EAL. NO_2 were 33.5 % of the EAL, occurring approximately 70 m from the MFB exhaust stack. This distance is likely to be within the site boundary and so members of the public would not be present and so EAL would likely not apply. This dropped to 7.7 % of the EAL at 300 m and so is considered insignificant.

Short-term impacts of aggregated DG – impacts of CO were predicted to be <10 % of the EAL and is considered to be insignificant. Short-term impacts of NO_2, SO_2 and PM_{10} were all predicted to be >10 % of the EAL at approximately 10 m from the exhaust stack. This is within the site boundary and so members of the public would not be present and EAL would likely not apply. At 300 m, SO_2 and PM_{10} were <10 % of the EAL and so are considered to be insignificant. NO_2 was predicted to be 92 % of the EAL at the approximate site boundary, and so cannot be considered insignificant yet is below the EAL nonetheless.

While it is clear that the NO_2 cannot be considered insignificant, it is thought that this does not identify a fundamental flaw in the environmental protections of the RR SMR site. This is as a result of the conservative assumptions used within the assessment that has impacted the predicted PC. Instead, this assessment should be undertaken again at a site-specific level and once both the RR SMR and CA technologies have matured in order to develop an accurate value.

Greenhouse Gas Emissions

Any combustion plant over 20 MW_{th} in the EU and UK would require a GHGE permit. In the EU the GHGE permit is under the Greenhouse Gas Emissions Trading Scheme Regulations 2012 [9], the instrument which regulates combustion plant operators' compliance with the EU ETS. In the UK, the UK ETS replaced the UK's participation in the EU ETS on 1 January 2021. The UK ETS is established through the Greenhouse Gas Emissions Trading Scheme Order 2020 [10]. The requirements of both regulations are very similar.

Both regulations require operators of qualifying plant to register for a GHGE permit and establish management arrangements to ensure records of engine running and fuel use are kept and reported to the regulators.

The GHGE permit is not required until just before the combustion plant starts operating.

31.5.4 Emission Mitigation Measures

The CA Topic Report has provided an early estimation of environmental impacts and risks associated with the proposed CA and can be used to explore emission mitigation strategies and RGP [34]. These opportunities are explored in further detail within the CA Topic Report [34], however, to summarise, the specific particulate emissions to air from the CA are listed below:

- NO_x – which may be comprised of NO_2 or nitric oxide (NO)
- SO_x – which may be comprised of SO_2 or sulphur trioxide (SO_3)
- PM – comprised of PM_{10} and $PM_{2.5}$
- Carbon dioxide (CO_2) and CO
- Volatile organic compounds (VOC) such as unburnt hydrocarbons.

It should be reiterated that the operation of the CA is not continuous and will likely be limited to short periods on a weekly/annually basis for commissioning, maintenance, or RR SMR plant start-up/LOOP, and during regularly planned use during maintenance.

Though there are commercially available nuclear power plant (NPP) certified DGs, these are primarily limited to 2 MWe rather than 1 MWe or 0.1 MWe. Thus, it is likely that such DGs would require a thorough design review and classification before deployment on an RR SMR site. This provides opportunities to optimise design aspects that could mitigate against or reduce emissions. Such options include but are not limited to:

Pre-installation emission mitigation options:

- Combustion chamber geometry to increase fuel efficiency and reduce risk of incomplete combustion.

- Combustion of lubricants or oils besides fuel oil.
- Implementation of auxiliary systems (e.g. fuel or air filtration).
- Higher stack height – disperses pollutants over a wider area and thus reduces the concentration. Also reduces risk of entrainment of pollutants via buildings or structures.

Pre-combustion emission mitigation options:

- Selection of alternative fuel types – More preferable within the MFB as it does not serve as a nuclear safety function. Use of low and ultra-low-sulphur fuels assist in reducing SO_2 emissions.
- Filtration of PM pre-combustion via:
    - Electrostatic precipitators
    - Fabric filters
    - Ceramic filters
    - Wet scrubbers; and
    - Cyclones
- Mechanical and electrical techniques to reduce NO_x:
    - Tuning the ignition and valve timing
    - Varying fuel/gas mixture stoichiometry
    - Regulating air intake temperature.

Post-combustion emission mitigation options:

- Selective catalytic reduction and selective non-catalytic reduction for reducing NO_x – injecting ammonia, urea and other compounds to produce nitrogen.
- Carbon capture and storage (unlikely due to the scale of a single RR SMR).
- Scrubbing techniques, such as desulphurisation, to minimise SO_2, PM, CO or unburnt hydrocarbons.

All options listed above have limitations to application and should be considered with these factors in mind when attempting to minimise/mitigate emissions. This includes ensuring that the chosen techniques do not reduce the efficiency of the generators such as may be the case for mechanical/electrical techniques to reduce NO_x or pose a potential safety risk. For example, choosing bio or synthetic fuel as these have the potential to cause fuel degradation, sedimentation and bacterial growth.

It is imperative that implementing such options do not impact the nuclear safety functions that these provide, and options should be weighed against the potential impacts to reliability and performance of the generators.

- **FA 31.4:** Further understand how design opportunities that minimise/reduce emissions from DGs affect nuclear safety functions.

31.6 COMAH

31.6.1 Current Status

The RR SMR chemical inventory is in development throughout 2024. As the design matures, an assessment will be carried out to identify the quantities of named or generic categories of dangerous substances that will be produced, used, handled and stored on site, and the COMAH aggregation calculations will be undertaken to determine whether a RR SMR is likely to be a COMAH establishment (and whether it is lower or upper tier).

Based on current information available at RD7/DRP1, the RR SMR is unlikely to be upper tier COMAH establishment and the following transverse requirement (R-568): 'The design shall avoid so far as is reasonably practicable the types of hazard encompassed by SI 2015/485 The COMAH 2015 Regulations' has been placed on engineers designing the systems.

- **FA 31.5:** Confirm volumes and types of chemicals to be used and stored on the RR SMR site and assess against COMAH Regulations, information is to be provided in the COMAH topic report.

31.6.2 Regulatory Context

The COMAH Regulations [11] relate to the prevention, control and mitigation of the effects of accidents. They apply to establishments that store or use quantities of named or generic categories of dangerous substances above specified qualifying thresholds. The COMAH Regulations specify two threshold quantities for each listed substance or risk category of substance: the lower quantities are the threshold for lower tier COMAH establishments, the higher quantity is the threshold for upper tier COMAH establishments. For any establishment falling in either the upper or lower tier, the operator must take all measures necessary to prevent major accidents and limit their consequences for human health and the environment. The COMAH Regulations cover both mixed and pure substances as classified in accordance with the CLP Regulation and wastes with major accident potential. The COMAH Regulations do not cover radioactive materials.

Further consideration will be given to how many units at one location exist that may change the COMAH category, and the potential that the COMAH status of the site may change dependent on the chemical inventory during specific stages of the RR SMR lifecycle, such as during decommissioning.

Whilst it is recognised that there may be future changes that result in the RR SMR falling within a different COMAH tier to that currently anticipated, the design is being undertaken to avoid, as reasonably practicable, the types of hazards encompassed by the COMAH regulations.

31.6.3 Summary of Proposed Assessments

Future iterations of this chapter will provide the maximum quantities of any dangerous substances that will be stored on the RR SMR site once proposed dangerous substances are fully known. These quantities will be compared with the corresponding COMAH qualifying levels and classification of site to determine whether a RR SMR is likely to be a COMAH establishment, and whether it is lower or upper tier. If the site is a COMAH site, a description will be provided in future versions of the E3S Case of the measures incorporated in the design to prevent a major accident to the environment

(MATTE), which will be based upon the chemical and downstream oil industries forum (CDOIF) environmental risk assessment method.

31.7 Fluorinated Greenhouse Gases and Ozone Depleting Substances

31.7.1 Current Status

The RR SMR chemical inventory is currently in development throughout 2024 and thus fluorinated greenhouse gases and ozone depleting substances are not identified at RD7/DRP1.

31.7.2 Regulatory Context

In April 2022, the EC made a legislative proposal [42] to update the 'Fluorinated Greenhouse Gases Regulations' [12] [43] [44] with the intention to:

- Deliver higher ambition, for example, through a tighter quota system for HFCs – HFC phase-down: reduce the amount of HFCs placed on the market by 98 % by 2050 (compared to 2015). New restrictions on the use of fluorinated gases in equipment are also included.
- Ensure compliance with the Montreal Protocol, e.g. making phase-down steps also after 2030 and ending certain exemptions to the EU's HFC phase-down that do not exist under the Montreal Protocol.
- Improve enforcement and implementation, e.g. by making it easier for customs and surveillance authorities to control imports and exports. A quota price will be introduced, and penalties will become harsher and more homogenous across the EU.
- Achieve more comprehensive monitoring, e.g. by covering a broader range of substances and activities and improving the procedures for reporting and verifying data.

To what extent regulations in England and Wales will follow EU changes is presently unknown, however these requirements are likely to be upheld and as RR SMRs are to be deployed world-wide, compliance with these regulations will be adhered to. Regulations covering England and Wales will be monitored as the project proceeds.

Within UK regulatory guidance 2024 [13] it is expected that the user (applicable to the dutyholder/licensee/permit holder) of fluorinated gases will need to:

- Have qualifications and company certification to work with fluorinated gases.
- Maintain and check relevant equipment using fluorinated gases for leaks.
- Record fluorinated gases within relevant equipment.
- Recover, reclaim or recycle fluorinated gases.
- Follow rules for operating and servicing high voltage switchgear that contains SF_6.

31.7.3 Summary of Proposed Assessments

The design will be reviewed to identify whether the use of any fluorinated gases or ozone-depleting gases is proposed. Where any are proposed, the potential to avoid their use or their replacement with less harmful alternatives will be reviewed noting that whichever gases are used, the design should ensure leaks do not occur and the system can be inspected and maintained in accordance with regulations. Where they cannot be replaced, a description will be provided of the measures taken in the design to prevent and minimise leakage. A report will be provided on this matter demonstrating use of BAT and compliance against relevant regulations at a later stage once the proposed fluorinated gases and ozone-depleting gases are known.

- **FA 31.6:** Identify the types and volume of fluorinated gases to be used on the RR SMR and ensure relevant legal requirements are incorporated into the engineering design and captured in the fluorinated gas and ozone-depleting substances topic report.

31.8 Conclusions

31.8.1 ALARP, BAT, Secure by Design, Safeguards by Design

Information relating to conventional environmental regulations that need to be reflected in the RR SMR and covered in E3S Case have been presented in chapter 31 based on the current design at RD7/DRP1. The sources of conventional environmental aspects and the applicable regulations needed to effectively manage these aspects have been identified. As the design of the RR SMR matures, BAT will be applied to ensure the RR SMR will be optimised to minimise environmental impacts and to comply with all legal requirements. For example, the CA Topic Report [34] has highlighted the optioneering process that demonstrates BAT principles in order to develop the chosen option considering safety, technological feasibility, environmental impacts and other criteria.

The conventional environmental aspects of the RR SMR at RD7/DRP1 and the applicable environmental regulations have been identified within chapter 31. The arrangements for the RR SMR detailed within this chapter are considered to align with and satisfy UK regulatory requirements, and as a result be compliant with international regulations. Furthermore, the water abstraction, discharges to surface water and CA sections have demonstrated how the design has been developed in line with the optioneering process which has integrated BAT, ALARP, secure by design and safeguards, as well as capturing aspects of sustainability at a fundamental level from the onset.

As the design of the RR SMR matures, BAT will be applied to ensure the RR SMR will be optimised to minimise environmental impacts and to comply with all legal requirements.

Future iterations of chapter 31 will provide more detailed characteristics of the conventional environmental aspects of the RR SMR, the techniques proposed to manage these aspects and minimise their impact on the environment and how the engineering design fulfils legal obligations.

It is recognised that many of the conventional environmental impacts will be site specific, for example marine life protection and the cooling water system. However, the RR SMR is being designed with the required flexibility to apply the most suitable techniques and not foreclose options.

31.8.2 Assumptions and Commitments on Future Dutyholder/ Licensee/Permit Holder

The following assumptions and commitments pertaining to conventional environmental impacts and other environmental regulations in Table 31.8-1 are to be placed upon the future dutyholder/licensee/permit holder.

Further environmental assumptions and commitments for permit holders will be captured in future versions of the E3S Case.

Table 31.8-1: Assumptions and Commitments on Future Dutyholder/Licensee/Permit Holder

Assumption/Commitment	ID	Description
Commitment	C31.1	Future permit holder will be required to confirm and abide by the regulations on DGs under EPR2016. Any DGs would be expected to be excluded generators under EPR2016 Schedule 25B (specified generator controls), by virtue of a specific exclusion for emergency plan on nuclear licensed sites. This will be confirmed with the regulators during the permit application process (by the future permit holder).
Commitment	C31.2	Future permit holder will register for a greenhouse gas permit. Operators of qualifying plants must register for a 'greenhouse gas permit' and establish management arrangement to ensure records of engine running and fuel use are kept and reported to the regulators under the EU ETS and UK ETS. Note this is not needed until the combustion plant is in use.
Commitment	C31.3	Future permit holder will follow the procedure of alternating channels within the ACMS. For even wear and tear on the filtration equipment, the operator should switch the flow from one channel to the other at a frequency of once per week within the ACMS. This is to align with the through life activities for the filtration equipment.
Commitment	C31.4	Future permit holder will need to understand the thermal impact of discharges. Assessing the environmental impact of the thermal plume generated by the cooling water discharge will need to be undertaken in detail at the site-specific permitting stage.

Assumption/Commitment	ID	Description
Commitment	C31.5	Future permit holder will need to follow regulatory guidance on fluorinated gases. Within UK regulatory guidance 2024, it is expected that the user (applicable to the dutyholder/licensee/permit holder) of fluorinated gases will need to: • Have qualifications and company certification to work with fluorinated gases. • Maintain and check relevant equipment using fluorinated gases for leaks. • Record fluorinated gases within relevant equipment. • Recover, reclaim or recycle fluorinated gases. • Follow rules for operating and servicing high voltage switchgear that contains SF_6.

31.8.3 Conclusions and Forward Look

The generic E3S Case objective at Version 2 is 'to provide confidence that the RR SMR design will be capable of delivering the E3S fundamental objective as it developed from a concept design into a detailed design' [1]. This confidence is built through development and underpinning of top-level claims across each chapter of the E3S Case, through supporting arguments and evidence. The top-level claim for chapter 31 is 'the conventional environmental impacts of the RR SMR are minimised'.

The arguments and evidence presented to meet the generic E3S Case objective at Version 2 include embedding and integrating conventional environmental principles into the design decision and optioneering process. A general set of conventional environmental design requirements are established in the RR SMR requirements management system as NFSRs and are applied to SSCs through engineering processes. The application of these processes supports the ongoing design of the RR SMR to minimise the conventional environmental impacts.

FAs have been developed to support the continual development of the E3S Case and build confidence that the RR SMR can deliver the fundamental E3S objective. A summary of FAs is provided in Table 31.8-2. These FAs will be reported in future iterations of chapter 31 to further demonstrate that the chapter meets the E3S fundamental objective.

Table 31.8-2: Forward Action Plan for Further Development of Chapter 31

ID	Description	Required for
FA 31.1	Development of a sustainable water strategy, such as rainwater harvesting and recycling.	Ongoing – water mass balance is being developed and due November 2024. After this work is completed, sustainable water strategies and opportunities will be looked at in more detail (mid 2025)
FA 31.2	Understand the impacts of recirculating blowdown on marine life.	February 2025
FA 31.3	Further understand regulatory requirements and where MFBs fall under the Part B permit as STUs.	Q2 2025
FA 31.4	Further understand how design opportunities that minimise/reduce emissions from DGs affect nuclear safety functions.	Q2 2025
FA 31.5	Confirm volumes and types of chemicals to be used and stored on the RR SMR site and assess against COMAH Regulations, information is to be provided in the COMAH topic report.	Initial chemical inventory is due August 2024 COMAH assessment will follow – topic report due October 2025
FA 31.6	Identify the types and volume of fluorinated gases to be used on the RR SMR and ensure relevant legal requirements are incorporated into the engineering design and captured in the fluorinated gas and ozone-depleting substances topic report.	February 2025

31.9 References

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31.10 Appendix A

The associated top-level claim for chapter 31 is 'the conventional environmental impacts of the RR SMR are minimised'.

Table 31.10-1 provides a mapping of the claims to the corresponding sections of the chapter that summarise the arguments and/or evidence. The full decomposition of claims and link to underpinning Tier 2 and Tier 3 information containing the detailed arguments and evidence is presented in the E3S Case CAE Route Map [4]. The route map includes the trajectory of Tier 2 and Tier 3 information as the generic E3S Case develops, which will be incorporated into Tier 1 chapters as it becomes available and in line with generic E3S Case versions described in [1].

Table 31.10-1: Mapping of Claims to Chapter Sections

Claim	Section of chapter 31 containing arguments / evidence summary
RR SMR minimises the use of resources (water, energy and space/footprint)	Water use and abstraction: 31.2.2, 31.2.4, 31.2.5 Discharges to surface water: 31.3.5 Operation of installations: 31.5.1 See E3S Case Version 2, Tier 1, Chapter 27: Demonstration of Best Available Techniques [45] for further detail on these topics. This will also be covered within the future E3S Case Version 4, Tier 1, Chapter 26: Sustainability.
RR SMR prevents, or where this is not possible, minimises the emission of substances which give rise to environmental impact (e.g. chemicals, hydrocarbons, greenhouse gases, ozone depleting substances, etc.)	Discharges to surface water: 31.3.3 Discharges to groundwater: 31.4 Operation of installations: 31.5.1, 31.5.3, 31.5.4 COMAH: 31.6.1 Fluorinated gases and ozone depleting substances: 31.7.3 See E3S Case Version 2, Tier 1, Chapter 27: Demonstration of Best Available Techniques [45] for further detail on these topics. This will also be covered within the future E3S Case Version 4, Tier 1, Chapter 26: Sustainability.

RR SMR prevents, or where this is not possible, minimises the detrimental environmental impact of the design through: a) Sustainable materials selection (e.g. to improve the performance/longevity of structures and components)	a) Water use and abstraction: 31.2.4, 31.2.5 Further detail on these topics are within E3S Case Version 2, Tier 1, Chapter 20: Chemistry [46] (and in future chemical inventory), and E3S Case Version 2, Tier 1, Chapter 27: Demonstration of Best Available Techniques [45]. This will also be covered within the future E3S Case Version 4, Tier 1, Chapter 26: Sustainability.
b) Substitution of materials with less hazardous alternatives	b) See E3S Case Version 2, Tier 1, Chapter 20: Chemistry [46] and E3S Case Version 2, Tier 1, Chapter 27: Demonstration of Best Available Techniques [45] for further detail on these topics.
c) Noise, odours and other nuisance	c) Noise, odours and other nuisances are not covered in this iteration of chapter 31.

31.11 Appendix B

31.11.1 Potential Environmentally Significant SSCs

Using the method set out in [3], the SSCs identified in Table 31.11-1 have been captured for consideration as environmentally significant equipment that contribute to an EPM. These SSCs are subject to review prior to entry within the dynamic object-oriented requirements system (DOORS).

Further detail on these SSCs can be found within system design descriptions (SDDs) and functional bills of materials (FBoMs) for the specific systems.

Table 31.11-1: Potential Environmentally Significant SSCs

System	Function performed by an SSC of the system	High-level environmental function	Description
Water Abstraction			
[UP]	Sea intake head	Mitigation	Positioned parallel to predominant wave direction and designed to reduce system velocity and to exclude items >150 mm to reduce fish entrainment and death.
[UP]	Fish collection and return system	Mitigation	Designed to reduce system velocity and using low roughness coefficient material to reduce fish damage and death.
[UP]	Intake flow measurement	Sampling and monitoring	Provides measurement of intake flow.
[PE]	Submerged filters	Mitigation	Designed to reduce system velocity and allow fish to remain submerged in order to reduce fish damage and death.
[PU]	Cooling water dosing and monitoring system	Sampling and monitoring	To provide relevant information on in-process performance of cooling water chemical dosing system.
[PA]	Drift eliminators (MCWS)	Mitigation	Reduce impact of aerial discharges from MCWS by reducing cooling water loss to the environment and reduces salt drift.

System	Function performed by an SSC of the system	High-level environmental function	Description
[PB]	Drift eliminators (ESWS)	Mitigation	Reduce impact of aerial discharges from ESWS by reducing cooling water loss to the environment.
Operation of installations			
[QH]	Monitoring and sampling systems	Sampling and monitoring	To monitor emissions and gaseous discharges from the DGs.
[QH]	Containment systems and bunds	Waste treatment and abatement	Bunds and surrounding containment systems to contain any spills or leaks.
Surface water discharge			
[GM]	Outdoor secondary containment bunds	Waste treatment and abatement	To contain any spills or leaks.
[GM]	Structures and areas for electrical grid and distribution system (transformer bunds)	Waste treatment and abatement	To contain any spills or leaks.
[GM]	Storage system outside fluid treatment system	Waste treatment and abatement	To contain and allow for treatment of effluent, removal of oil, and to prevent the accumulation of solids.
[GM]	Wastewater filtering and mechanical cleaning system	Waste treatment and abatement	Removes suspended solids and oil. Critical to minimising impacts of discharges into the environment.
[GM]	Sump drains buffer tanks	Waste treatment and abatement	Settles oil, water and solids for off-site disposal.
[UQH]	Boiler house sump	Waste treatment and abatement	To collect and remove effluent.
[UMA]	Turbine hall sump	Waste treatment and abatement	To collect and remove effluent.
[KTA30]	Chemical drains	Waste treatment and abatement	To keep chemical drain effluent from other effluent categories.
[KTA30]	Chemical drains tanks	Waste treatment and abatement	To contain and allow for treatment of chemical effluent.
[KTA20]	Process drains	Waste treatment and abatement	To keep process drain effluent from other effluent categories.

System	Function performed by an SSC of the system	High-level environmental function	Description
[KTA20], [GM], [ZZT]	Floor drains	Waste treatment and abatement	To keep floor drain effluent from other effluent categories.
[KTA40]	Non-active drains	Waste treatment and abatement	To keep non-active drain effluent from other effluent categories.
[KTA40], [GM]	Non-active drains tanks	Waste abatement and treatment	To contain and allow for treatment of non-active effluent.
[QU]	Monitoring and sampling system	Sampling and monitoring	To sample our discharges to the environment.

It should be noted that as the design of the RR SMR is still in development and systems are progressing in maturity, some environmentally significant SSCs cannot be identified at RD7/DRP1. This applies to CA systems and generators which are progressing in maturity and may be identified in greater detail within the next iteration of chapter 31. This also applies to SSCs that interface with fluorinated gas and ozone depleting substances.

SSCs for MFBs are out of scope for this chapter, but further information may be available at a later stage within the design of the RR SMR.

COMAH systems have not been identified in significant detail, this is partly due to the chemical inventory being undertaken throughout 2024 which will provide further information on the use of chemicals and inform environmentally significant systems, such as secondary containments. These SSCs may be identified in the next iteration of chapter 31.

31.12 Glossary of Terms and Abbreviations

ACMS	Auxiliary Cooling and Make-up System
ALARP	As Low As Reasonably Practicable
B01/BOP	Balance of Plant
BAT	Best Available Techniques
BREF	Best Available Techniques Reference
C01/CWI	Cooling Water Island
CA	Combustion Activity
CAE	Claims, Arguments, Evidence
CDOIF	Chemical and Downstream Oil Industries Forum
CIRIA	Construction Industry Research and Information Association
CI-LMDS	Conventional Island Liquid Monitoring and Discharge System
CLP	Classification, Labelling and Packaging
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COMAH	Control of Major Accident Hazards Regulations
COTS	Commercial Off The Shelf
CTBD	Cooling-Tower Blowdown
DEFRA	Department for Environment Food and Rural Affairs
DG	Diesel Generator
DOORS	Dynamic Object-Oriented Requirements System
DRP	Design Reference Point
E3S	Environment, Safety, Security and Safeguards
EA	Environment Agency
EAL	Environmental Assessment Limits
EC	European Commission
ELV	Emission Limit Values
EMIT	Examination, Maintenance, Inspection and Testing
EPF	Environment Protection Function
EPM	Environment Protection Measure

EPR2016	Environmental Permitting Regulations 2016
ESWS	Essential Service Water System
EU	European Union
EU ETS	European Union Emissions Trading Scheme
FA	Forward Action
FBoM	Functional Bill of Material
GDA	Generic Design Assessment
GHGE	Greenhouse Gas Emissions
HFC	Hydrofluorocarbons
HMIP	Her Majesty's Inspectorate of Pollution
HPC	Hinkley Point C
HVO	Hydrogenated Vegetable Oil
IPCC	Integrated Pollution Prevention and Control
LOOP	Loss Of Offsite Power
LVSE	Low-velocity Side Entry
MATTE	Major Accident To The Environment
MCP	Medium Combustion Plant
MCPD	Medium Combustion Plant Directive
MCWS	Main Cooling Water System
MDCT	Mechanical Draught Cooling Towers
MFB	Mobile Fired Boilers
MSL	Mean Sea Level
MW_e	Mega Watt Electric
MW_{th}	Mega Watt Thermal
NFPR	Non-Functioning Performance Requirement
NFSR	Non-Functioning System Requirement
NO_x	Nitrogen Oxides
NO	Nitric Oxide

NO_2	Nitrogen dioxide
NPP	Nuclear Power Plant
NRW	Natural Resources Wales
ONR	Office for Nuclear Regulation
OPEX	Operational Experience
PC	Process Contribution
PFC	Perfluorocarbons
PM	Particulate Matter
R01/RI	Reactor Island
RD	Reference Design
RGP	Relevant Good Practice
RP	Requesting Party
RR SMR	Rolls-Royce Small Modular Reactor
SDD	System Design Description
SG	Steam Generator
SO_x	Sulphur Oxides
SO_2	Sulphur Dioxide
SO_3	Sulphur Trioxide
SF_6	Sulphur Hexafluoride
SSC	Structures, Systems and Components
STU	Stational Technical Unit
T01/TI	Turbine Island
TBD	To Be Determined
TI-CCWS	Turbine Island Closed Cooling Water System
UK	United Kingdom
UK ETS	United Kingdom Emissions Trading Scheme
VOC	Volatile Organic Compounds