Sizewell C Project

Radioactive Substances Regulation (RSR) Permit Application

Appendix C

Support Document C2 –Environmental Monitoring

This page has been intentionally left blank

CONTENTS

LIST OF FIGURES

LIST OF TABLES

Introduction

1.1 Purpose

1. Environmental radioactivity monitoring is required to be undertaken by NNB Generation Company (SZC) Limited (SZC Co.) to demonstrate compliance with the Radioactive Substances Regulation (RSR) permit for Sizewell C (SZC). This will start prior to active commissioning before and discharges of radioactive effluents take place. SZC Co. will review available environmental radioactivity monitoring data and determine what, if any, additional monitoring may be required around the SZC site in order to provide a baseline to which measurements can be compared when the power station becomes operational. Detailed information on how SZC Co. will undertake environmental radioactivity monitoring at SZC will be developed in time, through development of an Environment Radioactivity Monitoring Plan (ERMP).

2. The term "monitoring" is used in this document in its broadest context and as shorthand for direct radiation or radiation contamination monitoring by instruments or the analysis and assessment of environmental samples for radioactivity.

3. SZC Co. will seek agreement of the monitoring objectives for the programme from relevant stakeholders, including the Environment Agency. The arrangements will be formalised with the regulator prior to implementation in line with the requirements of the relevant permit conditions.

4. The purpose of this document is to outline the approach that will be followed by SZC Co. to develop, implement and review the environmental radioactivity monitoring programme for SZC. SZC Co. does not anticipate making any disposals or discharges or radioactive waste during the construction phase and early commissioning phases of the project. Therefore, it is planned to fully implement the relevant monitoring arrangements at the appropriate time for the project. Given that existing arrangements of neighbouring operators are in place for the site, monitoring and analytical techniques may further develop and habits of local population may change resulting in different pathways requiring consideration; all of these factors would be taken into account in any optimised environmental radioactivity monitoring programme developed by SZC Co. (see Section 4).

1.2 Scope

5. This document presents the key aspects required for environmental radioactivity monitoring and details how SZC Co. will develop the monitoring arrangements to comply with permit conditions imposed by the Environment Agency whilst demonstrating them as being Best Available Techniques (BAT). Section 2 presents the activities required to establish the SZC environmental monitoring arrangements, Section 4 presents the conclusions to support environmental monitoring at this stage of the SZC development and Section 3 specifies the Forward Actions to be undertaken by SZC Co. to develop the monitoring arrangements further and to demonstrate that these are BAT through the SZC Environment Case.

1.3 Definitions

Term / Abbreviation	Definition
BAT	Best Available Technique
CAE	Claim, Argument, Evidence
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CMT 7	Commitment Plan (7)

Term / Abbreviation	Definition
ERMP	Environmental Radioactivity Management Plan
EPR™	European Pressurized Water Reactor
ERMS	Environmental Radioactivity Monitoring Strategy
FSA	Food Standards Agency
FWP	Forward Work Plan
HPC	Hinkley Point C
MCERTS	Monitoring Certification Scheme
NNB GenCo (HPC)	NNB Generation Company Limited Hinkley Point C
OEF	Operational Experience Feedback
RIFE	Radioactivity in Food and the Environment
RSR	Radioactive Substances Regulations
SEPA	Scottish Environment Protection Agency
SZA	Sizewell A
SZB	Sizewell B
SZC	Sizewell C
SZC Co.	NNB Generation Company (SZC) Ltd

1.4 References

Ref	Title	Document No.	Version No.	Location	Author	Project*
1.	RSR Permit Application Head Document	100115743	1	EDRMS	SZC Co.	SZC
2.	Generic design assessment UK EPR™ nuclear power plant design by AREVA NP SAS and Electricité de France SA	NNB-OSL-REP-001714	-	EDRMS	EDF Energy/Areva NP	-
3.	Radioactive Substances Regulation Environmental Permit Application for Hinkley Point C	NNB-OSL-REP-000169	1	https://www.edfenergy.com/download-centre Last Accessed 28/02/2020	NNB GenCo (HPC)	HPC
4.	Application by NNB Generation Company Ltd to carry out radioactive substances activities at Hinkley Point C Power Station – Decision document	EPR/ZP3690SY/A001	-	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291292/LIT_7931_658948.pdf Last Accessed 28/02/2020	Environment Agency	-
5.	RSR Commitment Plan 7 – Monitoring and Reporting Assessment Plan	100178806	1	EDRMS	NNB GenCo (HPC)	HPC

Ref	Title	Document No.	Version No.	Location	Author	Project*
6.	Radiological Habits Survey: Sizewell, 2015	C6028	1	https://www.cefas.co.uk/publications/environment/sizewell2015.pdf Last Accessed 28/02/2020	CEFAS	SZC
7.	SZC RSR Permit Application Support Documents D1 – Human Radiological Impact Assessments	100197432	1	EDRMS	SZC Co.	SZC
8.	SZC RSR Permit Application Support Documents D2 – Non-Human Biota Radiological Impact Assessments	100133371	1	EDRMS	SZC Co.	SZC
9.	How to comply with your environmental permit for radioactive substances on a nuclear licensed site (February 2020)	-	2	https://www.gov.uk/government/publications/rsr-permits-for-nuclear-licensed-sites-how-to-comply/rsr-permits-for-nuclear-licensed-sites-how-to-comply Last Accessed 09/03/2020	Environment Agency	-
10.	Radiological Monitoring Technical Guidance Note 2 (December 2010)	GEHO0811BTVY-E-E	1	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/296529/geho0811btvy-e-e.pdf Last Accessed 28/02/2020	SEPA / FSA / Environment Agency	-
11.	SZC RSR Permit Application Support Document C1 – Plant Monitoring	100199173	1	EDRMS	SZC Co.	SZC
12.	RSR Environmental Principles	RSR 1	2	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/296388/geho0709bqsb-e-e.pdf Last Accessed 28/02/2020	Environment Agency	-
13.	Safety Standards Series: Environmental and source monitoring for the purposes of radiation protection	RS G-1.8	-	https://www-pub.iaea.org/MTCD/publications/PDF/Pub1216_web.pdf Last Accessed 28/02/2020	International Atomic Energy Agency	-
14.	Radioactivity in Food and the Environment, 2017	RIFE-23 (and predecessors)	-	https://www.gov.uk/government/publications/radioactivity-in-food-and-the-environment-rife-reports Last Accessed 28/02/2020	SEPA / FSA / Environment Agency	-
15.	HPC Environmental Radioactivity Monitoring Strategy	100178923	1	EDRMS	NNB GenCo (HPC)	HPC

Ref	Title	Document No.	Version No.	Location	Author	Project*
16.	SZC RSR Permit Application Support Document A1 – Environment Case	100198762	1	EDRMS	SZC Co.	SZC

2 DEVELOPMENT OF SZC ENVIRONMENTAL MONITORING ARRANGEMENTS

6. The sister site for the SZC nuclear power plant is in construction at Hinkley Point C (HPC). SZC Co. has established a replication strategy for the design of the SZC plant that that looks to copy as much of the design from HPC as possible, unless there are site specific differences that require adaptation. Full details of the design history and replication strategy adopted can be found in the RSR Permit Application Head Document [Ref 1].

7. The UK EPR™ Generic Design Assessment [Ref2] and subsequent HPC RSR permit application [Ref 3] proposed a set of monitoring techniques based on international best practice, which demonstrated that the design would also comply with UK regulatory requirements. The subsequent HPC permit Environment Agency Decision Document [Ref 4] noted Information Condition 16, requiring NNB Generation Company Limited Hinkley Point C (NNB GenCo (HPC)) to confirm the environmental monitoring requirements for HPC and to demonstrate that BAT had been applied. In response, NNB GenCo (HPC) established HPC Commitment Plan 7 (CMT 7) [Ref 5] to illustrate how the work to complete the monitoring arrangements will be undertaken.

8. SZC Co. intends to base the development of the SZC environmental monitoring arrangements, where appropriate, on common elements of the work identified for HPC in CMT 7. This will allow consistent best practice and expertise across both sites (i.e. procedures, testing regimes) to be shared. It will not be appropriate to share all aspects, for example site specific elements (such as local baseline data or use of monitoring personnel). As with HPC, the intention would be for SZC to close out the relevant acitivities from HPC CMT 7 prior to operation, allowing sufficient time for implementation which is expected to be around 18 months prior to the start of operations. In order to manage and plan this work, commitment 5 (Environmental Radioactivity Monitoring Programme) has been identified within the Forward Work Plan (FWP) as part of the RSR permit application (See section 7.2 of the Head Document).

9. There are 7 activities that SZC Co. intend to complete to establish the environmental monitoring arrangements for the SZC project, as described below. SZC Co. will continue engagement with the regulators on the proposals for the activities and their timescales of delivery. In addition, liaison with local stakeholders will be undertaken to establish the potential for sharing local environmental data and to examine if there is any scope to combine any of the monitoring regimes undertaken at Sizewell A and B (SZA, SZB).

10. Monitoring and sampling of the environment and foodstuffs around nuclear facilities can vary from year to year and should be representative of exposure pathways in the locality of the nuclear site. Knowledge of the pathways is informed by regular surveys of local people's diets and lifestyles, which has been obtained from Centre for Environment, Fisheries and Aquaculture Science (CEFAS) radiological habits survey reports [Ref 6].

11. The most relevant exposure pathways from SZC are expected to be (as is the case for most other nuclear power plants):

    - From gaseous discharges – ingestion of terrestrial foods, inhalation of airborne activity and external

exposure from material in the air deposited on land.

- From liquid discharges to the marine environment – ingestion of marine fish and seafood and external exposure from contaminated silts and sediments.
- From external radiation and skyshine from site infrastructure.

12. The assessment of exposures from these releases for SZC is discussed in RSR Permit Application Support Document D1 (SZC Human Radiological Impact Assessment) and D2 (SZC Non-Human Biota Radiological Impact Assessment [Ref 7] [Ref 8].

2.1 Activity 1: Development of an Environmental Radioactivity Monitoring Strategy

13. An Environmental Radioactivity Monitoring Strategy (ERMS) is the mechanism employed by SZC Co. to establish the scope and requirements of environmental monitoring (and sampling, analysis and reporting) at their nuclear facilities.

14. The aims of the ERMS are to:

- Demonstrate compliance with the expected Environment Agency RSR Permit conditions relevant to environmental monitoring [Ref 9] and summarised as;
  - Condition 3.2.1 define, document and carry out an environmental monitoring programme, using BAT, and informing the Environment Agency in advance of any modifications to the programme;
  - Condition 3.2.2 maintain records of all monitoring required by this permit including records of the taking and analysis of samples, instrument measurements (periodic and continual), calibrations, examinations, tests and surveys and any assessment or evaluation made on the basis of such data;
  - Condition 3.2.3 have Monitoring Certification Scheme (MCERTS) certification or MCERTS accreditation for monitoring equipment, techniques (including radioanalysis), personnel and organisations, unless otherwise agreed in writing by the Environment Agency;
  - Condition 3.2.5 if required, take and keep samples as specified by the Environment Agency;
  - Condition 3.2.6 carry out regular calibration and checking of systems and equipment provided for measuring and assessing exposure of members of the public and radioactive contamination of the environment.
- These also cover the main elements of a monitoring strategy as defined in the regulatory TGN M2:
  - Safety requirements
  - What to sample, when, how long for and how many samples
  - What techniques, methods and equipment to use
  - Where to sample from
  - How data will be collected, interpreted and reported
  - What quality assurance and control will be in place.
- Provide public/stakeholder reassurance;

- Monitor any effects and impacts on the environment, biota and human population as a result of radioactive discharges from SZC operations; these include as a result of discharges to air and water;
- Understand how radionuclides behave in the environment and assess long-term trends in their behaviour and distribution;
- Assess the impact on the most exposed group of individuals by determining the radioactivity they may be exposed to, including the local products that they consume; and,
- Detect radioactivity levels in the environment which might require reporting to the Environment Agency and require further investigation.

15. Production of the ERMS will align with Environment Agency guidance and best practice on environmental radioactivity monitoring programmes [Refs 9] [Ref 10],the Environment Agency's RSR Environmental Principles [Ref 12] that articulate the regulator's expectations with respect to monitoring and environmental assessment and with other specialist guidance with respect to environmental monitoring such as the International Atomic Energy Agency guidance [Ref 13]. This ERMS will define the numbers of samples required, the sampling/monitoring frequency, locations and radionuclides being analysed as well as the sampling, monitoring and analytical methods.

16. SZC Co. expect to follow the steps as shown in Table 2-1 to establish the SZC ERMS.

Table 2-1 Environmental Radioactivity Monitoring Strategy Process

Step	
1.	Collate existing information on source, pathway and receptors
2.	Assess environmental radioactivity monitoring programme risk
3.	Establish environmental radioactivity monitoring programme objectives
4.	Determine what to sample/monitor, where and how often
5.	Determine how to monitor/sample
6.	Determine what to analyse
7.	Determine appropriate arrangements
8.	Implement environmental radioactivity monitoring programme
9.	Review environmental radioactivity monitoring programme

17. The scope of environmental monitoring will include direct radiation monitoring or contamination monitoring, and the sampling, analysis and assessment of environmental media from the vicinity of SZC.

18. The ERMS will include 'ad hoc' enhanced monitoring. This will include proactive monitoring to minimise the potential risks such as during commissioning, or reactive ad hoc monitoring when elevated or abnormal discharges were made during routine operation of the SZC site. However, the strategy will exclude monitoring that will be part of the emergency arrangements for the site. In the event of a radiation emergency, SZC Co. would undertake environmental monitoring in accordance with the Emergency Plan and Handbook for the site, to characterise the composition of an off-site release and to assist with the protection of members of the public and the environment.

19. The outcome of this task will be an ERMS report. Section 4.1 presents its demonstration of BAT for SZC.

2.2 Activity 2: Establish SZC Baseline Environmental Data

20. To effectively monitor any effects and impacts on the environment, biota and human population as a result of the radioactive discharges from the operation of SZC, it is necessary to establish a baseline, pre-SZC operations; a dataset of the local environment characteristics.

21. To establish the baseline, SZC Co. will examine available local datasets; this would include (but is not limited to):

    - Environmental data collated during the previous SZC Environmental Impact Assessment work;
    - Liaison with Magnox Ltd and EDF Energy to explore the potential to obtain data collected from the environmental monitoring programmes undertaken for the SZA and SZB plants, respectively; and
    - Examination of the environment agencies (Environment Agency and Scottish Environmental Protection Agency (SEPA)) and the Food Standards Agencies (FSA) / Food Standards Scotland annual summary of the independent radioactivity monitoring programmes in the UK, known as Radioactivity in Food and the Environment (RIFE) [Ref 14]. This includes monitoring data from the Sizewell area (emanating from SZA and SZB).
    - CEFAS radiological habits survey reports [Ref 6].

22. The output of the collation of baseline data will be a report documenting the historical and current dataset and trends of radioactivity in the local environment, including foodstuffs, vegetation, waterbodies and atmosphere. Section 4.1 presents its demonstration of BAT for SZC. In order to manage and plan this work, Commitment 5 (Environmental Radioactivity Monitoring Programme) has been identified within the FWP as part of the RSR Permit Application Head Document (See section 7.2) [Ref 1].

23. The outcome of this task will be data collated in advance of active commissioning against which operational impacts from the SZC plant will be compared in future.

2.3 Activity 3: Review of fleet environmental monitoring experience

24. The SZC UK EPR™ plant is a replication of the HPC plant and is also directly related to the design and current operations of the French EPR fleet of reactors. A summary report of operational experience Feedback (OEF) of the environmental monitoring arrangements currently in place for the French fleet is being completed as part of the close out of CMT 7 by NNB GenCo (HPC). The HPC monitoring arrangements will incorporate best practice from this review.

25. Taking a series management approach, it is intended that the SZC monitoring arrangements will incorporate the outcomes and best practice from the French fleet OEF taking into consideration UK specific factors and requirements and, and taking into consideration the monitoring arrangements to be undertaken at HPC (presented in the HPC ERMS [Ref 15]), when establishing the SZC ERMP.

26. The outcome will be a report reviewing best practice across the EPR™ series and how that will be carried into the design of the SZC monitoring arrangements. Section 4.1 presents its demonstration of BAT for SZC.

2.4 Activity 4: Development of the SZC Environmental Radioactivity Monitoring Plan

27. The ERMP is the key document detailing how SZC Co. will carry out the environmental monitoring and sampling activities. It will take into account the outputs from Activities 1-3, Environment Agency radiological monitoring guidance [Ref 10], environmental optimisation guidance and any laboratory procedures and BAT assessments.

28. The SZC ERMP will recognise that at times it may need to be supplemented by additional environmental monitoring when necessary, for example, enhancing monitoring during commissioning stage; or during operations in response to incidents or reports of unusual or high discharges of radioactivity.

29. Consideration will be given to the best way of producing the output EMP report. Should the same approach as that identified by the HPC ERMS [Ref 15] be appropriate, an additional targeted monitoring programme shall run alongside the routine environmental monitoring programme. This programme will take place during active commissioning and early operations to establish a more specific dataset in the early period of the SZC project. Section 4.1 provides a demonstration of why this approach is BAT for the SZC EMP.

30. The outputs may therefore include:

    - SZC Operational ERMP: covering the routine monitoring arrangements to run during commissioning and operational phase of the project
    - SZC Project Specific ERMP: covering project specific programmes to be undertaken during active commissioning and potentially the first few years of operation.

    Section 4.1 provides a demonstration of why this approach is BAT for the SZC ERMP.

2.5 Activity 5: Development of Environmental Monitoring Techniques

31. Analysis and reporting of data following collection of samples from the environmental monitoring activities specified in the ERMP will involve the use of specialist laboratory facilities. At this stage of the SZC project it is not specified which analytical service facilities will be used but this will form part of the work when developing the ERMP in Activity 4.

32. The development of monitoring techniques will include review of the work completed in the ERMP on appropriate techniques to be used at SZC, the procedures on analysis, assessment and reporting (including specific analytical methods and lab accreditations) for the chosen laboratory facilities and the outcome of the review of series OEF (from Activity 3).

33. The output will be a report of the environmental monitoring techniques to be used at SZC, including the demonstration of BAT for each technique. The report will include detail of:

    - Method statements for undertaking monitoring/taking samples;
    - What analysis will be completed and to what standard;
    - What methods will be used to achieve relevant standard;
    - What quality arrangements are in place; and
    - How records will be kept.

34. Section 4.1 covers the demonstration of BAT for the monitoring techniques to be employed at SZC.

2.6 Activity 6: Development of Relevant Arrangements for Environmental Monitoring

35. It is important for SZC Co. to ensure that any external laboratory facilities used for the analysis and reporting of environmental sampling data is both appropriately accredited and has relevant agreements and arrangements in place to maintain the integrity of the samples and data reporting.

36. The development of the relevant arrangements will review the outputs of the previous activities, particularly the ERMP and techniques reports, the procedural documents for any laboratory facility used and also SZC Co. procedures.

37. It will be required for the laboratory used to analyse the environmental samples to be MCERTS accredited unless otherwise agreed in writing with the Environment Agency. As a minimum the laboratory would be UKAS accredited to ISO/IEC 17025 and SZC Co. will ensure that external laboratories deliver the service required through surveillance audits.

38. The output of this activity will be:

    - A set of management arrangement documents, including details of laboratory accreditation;
    - An implementation plan; and
    - Relevant training materials.

    Section 4.1 presents how the monitoring arrangements are demonstrated as being BAT at SZC.

2.7 Activity 7: Testing of the SZC Environmental Monitoring Arrangements

39. Before the developed monitoring arrangements can be considered robust and fully implemented, the arrangements will need to be tested to show they are adequate. Monitoring arrangements testing will be undertaken in advance of SZC active commissioning to ensure the arrangements are comprehensive and robust before any radioactive discharges begin from the site.

40. An internal (SZC Co.) readiness review will be undertaken, using the outputs of Activities 1-6 for the purposes of testing the monitoring arrangements. This will need to demonstrate that the arrangements are fit-for-purpose and are being appropriately applied on behalf of SZC Co. at SZC.

41. The output will be the readiness review report which will be provided to the Environment Agency. Section 4.1 demonstrates the proposed testing arrangements are BAT for SZC.

3 FORWARD ACTION PLAN

42. This support document provides appropriate information on the arrangements for environmental monitoring at SZC for the current stage of the project's development. With the addition of the actions identified herein, this document shows the steps necessary to provide arrangements for environmental monitoring at SZC are planned for in a timely manner that will allow the various limitations and conditions of the RSR environmental permit to be complied with at the appropriate time. The actions identify the most appropriate stage of the SZC project programme to deliver the action. Each action has been split into activities that need to be delivered in

order to complete the commitment linked to the action. Each action is also accompanied by a description and an explanation of the timing of the action. These actions are managed and delivered through SZC Co. management arrangements.

3.1 Demonstration of BAT in the Environment Case

43. Claim 5 of the Environment Case states that *SZC Co. shall undertake appropriate monitoring to check compliance with the conditions of the RSR permit*, which includes Environmental Monitoring.

44. As such, the Environmental Monitoring Arrangements will be demonstrated as BAT using a 'Claims', 'Arguments' and 'Evidence'(CAE) approach, defined as:

    - Claim - A high-level statement of what is being sought in terms of environmental optimisation. The Claim may be based on a specific permit condition or regulatory requirement.
    - Argument - An element which contributes to achieving a claim (or claims) and which links the evidence to the claim. This element can be deterministic, qualitative and/or quantitative. The argument contributes to the demonstration that a claim is valid.
    - Evidence - This is used as the basis of the argument i.e. how the argument can be validated and which allows further examination where required. Evidence can be facts, (e.g. based on established scientific principles and prior research or practices elsewhere), or assumptions.

45. The CAE for SZC encompass all elements of the business including (a) Plant - engineering and design, (b) People - role profiles and competency requirements, (c) Processes - management arrangements and (d) Governance - financial and decision-making arrangements. RSR Permit Application Support Document A.1 (Environment Case) [Ref 16] details the arguments and evidence for Claims 1-4, this document specifically presents the argument and evidence for Claim 5 regarding environmental monitoring. RSR Permit Application Support Document C.1 (Plant Monitoring) [Ref 11] details the other arguments within Claim 5 concerning plant monitoring.

46. Figure 3-1 provides an overview of the CAE for environmental monitoring to be undertaken at SZC of which the evidence section will be developed in due course as the monitoring arrangements are developed and the project nears construction through to operations.

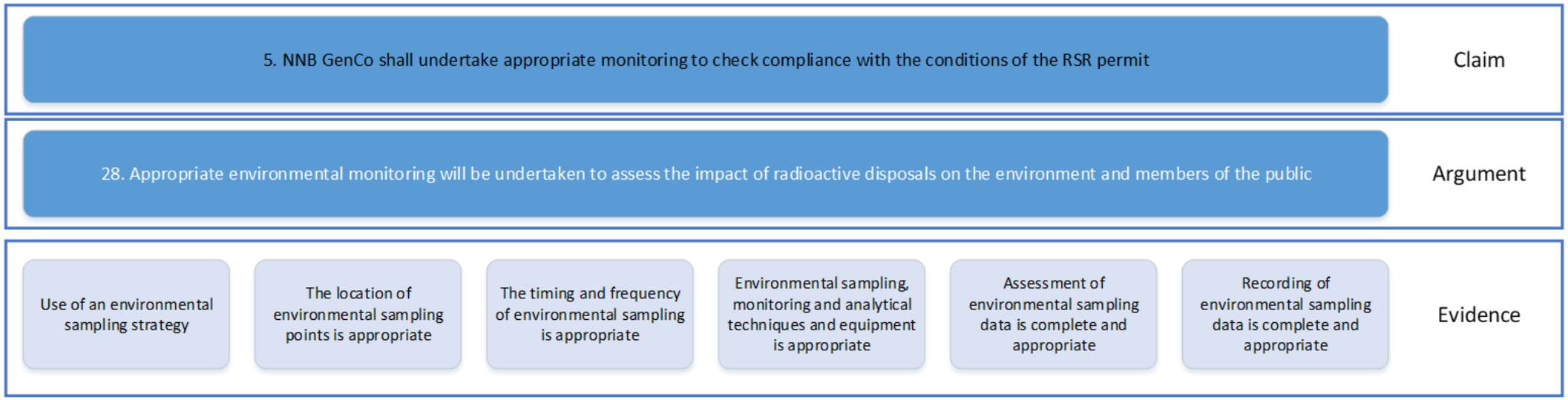

Figure 3-1 Claim 5 Argument 28

4 CONCLUSION

47. This support document demonstrates that SZC Co. understands the requirements for environmental monitoring at SZC and has an ongoing process to ensure that an appropriate management strategy will be developed and agreed with the regulators as the project progresses.

48. SZC Co. has the benefit of being able to call on experience from the series of UK and international EPR™ reactors to ensure best practice and operational experience from those facilities, that are at a more advanced stage in development, can be used to inform and optimise the SZC environmental monitoring strategy. BAT has been applied to the design of the SZC facility and will continue to be assessed during the development of the monitoring arrangements.

49. At this early stage of the SZC project i.e prior to the start of construction, there is no immediate requirement for environmental monitoring of the site. However, as the project develops, SZC Co. will initiate and complete relevant activities (see Sections 2.1 – 2.7) at an appropriate stage of the project (see Section 3) to fully establish the environmental monitoring arrangements and ensure permit compliance.

This page has been intentionally left blank