CGN EDF General Nuclear System	REGULATORY OBSERVATION RESOLUTION PLAN RO-UK-HPR1000-0028	Rev.: 0	Page: **1** / **6**
		GDA-REC-GNSL-005909	

REGULATORY OBSERVATION Resolution Plan	
RO Unique No.:	RO-UKHPR1000-0028
RO Title:	Adequate Justification of Estimated Public Doses for UK HPR1000
Technical Area(s)	Radiological Protection
Revision:	0
Overall RO Closure Date (Planned):	2020-09-30
Linked RQ(s)	RQ-UKHPR1000-0246
Linked RO(s)	
Related Technical Area(s)	Environmental
Other Related Documentation	GHX40200064DNFP03GN
Scope of Work	

Background

A Regulatory Query, RQ-UKHPR1000-0246 [1], was raised by the Office for Nuclear Regulation (UK) (ONR) to request off site dose measurements from a representative reactor and support the assessment of the Public Dose Evaluation from Direct Radiation Topic Report Rev B [2]. Following the response by the Requesting Party (RP) [3], it is ONR judgment that measurement data have not been supplied in sufficient detail to confirm that the dose rate measurements are consistent with the measureable range of background radiation near a representative operational reactor.

A Regulatory Observation (RO), RO-UKHPR1000-0028 [4], was subsequently raised by the ONR to:

- Explain ONR's regulatory expectations;
- Ensure the RP provides a robust demonstration that public dose rates in proximity to a "representative power plant" are within the measurable range of natural background levels; and to
- Assist ONR's judgement of whether doses to members of the public from direct radiation shine from the UK version of the Hua-long Pressurised Reactor (UK HPR1000) will be reduced So Far As Is Reasonably Practicable (SFAIRP).

The ONR's expectation is for the UK HPR1000 safety case to substantiate the claim that doses to members of the public from direct radiation have been reduced SFAIRP. In support of this demonstration, the ONR expect the RP to:

- Identify a comparable reactor and demonstrate that public doses from this reactor are comparable to UK HPR1000.
- Analyse and explain any differences
- Show that the measured dose rates are within the measurable range of background radiation dose

rates near to the comparable reactor.

- Consider the impact of other facilities such as radioactive waste and spent nuclear fuel stores.
- Demonstrate that public dose rates support the assertion that doses to members of the public from direct radiation are acceptable and reduced SFAIRP.

In line with the expectations set out above, this RO places 1 action:

RO-UKHPR1000-0028.A1 – Comparison of data from comparable operational plants with background.

Scope of work

General Nuclear System Limited as the RP recognises the obligations placed on them to demonstrate that the proposed design meets the regulatory requirements relevant to the assessment of prospective public doses and to the restriction of exposure SFAIRP. Whilst radiation doses may arise from direct radiation, inhalation or ingestion of radioactive material, or through the food chain as a result of discharges and disposals of radioactive waste, this scope of work is limited to off-site doses received as a result of direct radiation, for which the ONR have regulatory responsibility.

General Nuclear System Limited also recognises the importance of implementing relevant national and international guidance (for instance regulatory guidance, Public Health England (PHE) principles and International Atomic Energy Agency (IAEA) General Safety Guides) and ensuring that the safety case incorporates adequate documentation and arrangements that set out the claims, arguments and evidence and demonstrate the safety of the proposed design. In the case of the assessment of public doses, dose rate measurements taken from the representative site should confirm the claim that dose rates are consistent with known background radiation measurements, and in all cases not invalidate the computation method. The scope of this work is therefore to gain confidence in the assessment methodology for the UK HPR1000. This will support the claim that doses to members of the public are acceptable and reduced SFAIRP, which in turn will support the overall ALARP demonstration of public exposure to ionising radiation.

This resolution plan describes the approach adopted by General Nuclear System Limited to address action RO-UKHPR1000-0028.A1 and meet ONR's expectations. General Nuclear System Limited will aim to articulate clearly and unambiguously how the safety case meets the regulatory requirements and expectations relevant to the assessment of public doses. General Nuclear System Limited will update the radiation protection safety case to demonstrate the golden thread within its documentation. Appropriate timescales have been specified taking into consideration the overall project delivery plan and ONR assessment process.

Deliverable Description

A single action was incorporated into RO-UKHPR1000-0028.

RO-UKHPR1000-0028.A1 – Comparison of data from comparable operational plants with background.

In RO-UKHPR1000-0028, ONR states that - *in response to this action, the RP should:*

- *Identify a representative plant, or plants, to provide a meaningful comparison of the measured dose rates with the background radiation dose rates near the comparable reactor.*
- *Measure dose rates at a variety of distances whilst the plant is operating, in areas where background radiation levels are accurately known.*

- *Provide analysis of any differences between measurement and calculation, taking into account any differences between the operational reactor being measured and the UK HPR1000, such as reactor power and shielding design etc.*
- *Carry out a systematic determination of the background radiation dose rates using appropriate measurement devices stating what the errors are in any given data set and clearly stating what is included in background measurements and what has been subtracted. This may be by using data from prior to construction or using data obtained during outages. These data must be referenced.*
- *Provide a demonstration that the measured dose rates are within the measurable range of background radiation dose rates near the comparable reactor.*
- *Assess the impact of other buildings, such as radioactive waste and spent fuel stores on dose rates, drawing conclusions for UK HPR1000.*
- *Include this information in the UK HPR1000 generic safety case.*

Resolution Plan

Summary:

In line with the scope of work set out above, General Nuclear System Limited will produce a document, “Analysis of Environmental Dose Rate Measurements from the Representative Reactor”, which aims to identify a representative reactor site and assess the environmental radiation measurements by comparison against known background radiation on the site. The representative reactor is required to be representative of the UK HPR1000 and able to provide meaningful comparison of environmental dose rate measurements. The identification and selection of the representative reactor will be justified taking into account a number of factors. Differences between the representative reactor and the UK HPR1000 will be assessed in order to provide an input into the data analysis. For the assessment of environmental measurements, a statistical analysis will be undertaken to evaluate uncertainties associated with the measurement results and to determine if measurements from the operational reactor, in all operating modes, can be distinguished from known background radiation.

Significant amount of information is available from the representative power plant. This includes large amount of data from the environmental surveys carried out prior to construction and from the environmental monitoring programme implemented during plant operation. In the RQ-UKHPR1000-0246 response, only a small population of data was shared, and this did not cover all measurement locations nor data related to pre-construction environmental surveys. In the response to the RO action, General Nuclear System Limited intends to make use of all the information that is available to us and investigates potential trends considering measurement position and proximity to the operational site. Statistical analysis will be applied including an assessment of uncertainties to demonstrate that direct radiation from the representative operational reactor cannot be distinguished from background radiation. General Nuclear System Limited is confident that the objective set above can be achieved without the need for additional measurements to be taken. The environmental dose rates taken during plant operation will also be analysed taking into account potential impact from changes in reactor operating mode (start-up, power operation and shut-down), measurement errors and any other factors that may affect the results. Background radiation data taken from the site before

first reactor operation will also be analysed. Although background measurement locations may not correspond to the location of those measurements taken during power operation, the results are expected to provide useful information of the typical background radiation in the area. When undertaking the analysis, measurement uncertainties will be estimated and confidence in the measurement equipment and techniques will be confirmed.

The assessment of public doses for the UK HPR1000 [2] predicts that the direct radiation component is not statistically measurable when taking into account background fluctuations and measurement uncertainties. Therefore, a high level of confidence is expected from the above statistical analysis confirming the claim that measurements from the operational reactor cannot be distinguished from background radiation. To correlate the environmental measurements from the representative reactor to the assessment of public doses for the UK HPR1000, the analysis will consider the differences between the representative reactor and the UK HPR1000, particularly in terms of reactor power, shielding designs and the site layout.

The Public Dose Evaluation from Direct Radiation Topic Report [2] will be updated to include a summary of the “Analysis of Environmental Dose Rate Measurements from the Representative Reactor” and the evidence supporting the claim that measurements from the operational reactor cannot be distinguished from background radiation. When drawing conclusions for the UK HPR1000, the summary will assess the impact from other facilities such as the Interim Storage Facility for Intermediate Level Waste (BQZ) and the Spent Fuel Interim Storage Facilities (BQF) as an additional component of direct exposure for the UK HPR1000 compared to the selected representative operational reactor. The assessment of public doses for the UK HPR1000 [2] and the new document will support the assertion that doses to members of the public from direct radiation are acceptable and reduced SFAIRP.

Detailed Steps:

- Produce a new document, “Analysis of Environmental Dose Rate Measurements from the Representative Reactor”
  - Identification of the representative reactor.
  - Comprehensive information gathering from the representative reactor site including historical data related to background radiation.
  - Undertaking a review of the information and a statistical analysis of environmental dose rate measurements.
  - Providing a demonstration that the environmental measurement results are within the range of background radiation dose rates.
  - Provide analysis of the differences between the environmental measurements and the assessment undertaken for the UK HPR1000.
- Update the Public Dose Evaluation from Direct Radiation Topic Report
  - Incorporate a summary of and a reference to the “Analysis of Environmental Dose Rate Measurements from the Representative Reactor”.
  - Draw conclusions for the UK HPR1000 whilst considering the impact from BQZ and BQF.
  - Demonstrate that the environmental measurement results support the assertion that doses to

members of the public from direct radiation are acceptable and reduced SFAIRP.

- Update PCSR Chapter 22
  - Amend Section 22.10 to incorporate the summary, from the Public Dose Evaluation from Direct Radiation Topic Report [2], of the "Analysis of Environmental Dose Rate Measurements from the Representative Reactor".

Impact on the GDA Submissions

The information that will form part of the response to this RO will be incorporated into PCSR Chapter 22 V2 and their supporting documents. The planning for submission of the documents that will provide the response to this RO is as follows:

Title of Submission	Planned Submission Date
Analysis of Environmental Dose Rate Measurements from the Representative Reactor	30/4/2020
Public Dose Evaluation from Direct Radiation Topic Report	29/5/2020

Timetable and Milestone Programme Leading to the Deliverables

A Gantt chart to present the timetable and milestone of the RO resolution in APPENDIX A.

Reference

[1] ONR, RQ-UKHPR1000-0246 Public Dose Measurements, 24/05/19.

[2] CGN, Public Dose Evaluation from Direct Radiation Topic Report, GHX40200064DNFP03GN, Rev B, CGN, March 2019.

[3] CGN, RQ-UKHPR1000-0246 Public Dose Measurements – Full Response, August 2019.

[4] ONR, RO-UKHPR1000-0028 Adequate Justification of Estimated Public Doses for UK HPR1000, December 2019.

CGN EDF General Nuclear System	REGULATORY OBSERVATION RESOLUTION PLAN RO-UK-HPR1000-0028	Rev.: 0	Page: **6 / 6**
		GDA-REC-GNSL-005909	

APPENDIX A RO-UK-HPR1000-0028 Gantt Chart

	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20
RO A1												
RO A1 Deliverable 1												
Development of deliverable-[Analysis of Environmental Dose Rate Measurements from the Representative Reactor]												
Submission of deliverable-[Analysis of Environmental Dose Rate Measurements from the Representative Reactor]				▲								
RO A1 Deliverable 2												
Development of deliverable-[Public Dose Evaluation from Direct Radiation Topic Report (updated version)]												
Submission of deliverable-[Public Dose Evaluation from Direct Radiation Topic Report (updated version)]					▲							
Assessment												
Regulators Assessment												
Target RO Cloure Date									▲			