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### REGULATORY OBSERVATION Resolution Plan

<b>RO Unique No.:</b>	RO-UKHPR1000-0019
<b>RO Title:</b>	Substantiation of Initiating Event Frequencies in the PSA
<b>Technical Area(s)</b>	PSA
<b>Revision:</b>	0
<b>Overall RO Closure Date (Planned):</b>	2020-12-31
<b>Linked RQ(s)</b>	RQ-UKHPR1000-0056, RQ-UKHPR1000-0235
<b>Linked RO(s)</b>	
<b>Related Technical Area(s)</b>	Fault Studies
<b>Other Related Documentation</b>	

#### Scope of Work


##### **Background and Regulator's Expectations**

*ONR expects the safety case for new reactors to include a suitable and sufficient Probabilistic Safety Analysis (PSA) that adequately represents the design of the facility, that is realistic and that uses relevant data that is suitably underpinned. To this end, ONR is seeking to gain confidence in the requesting party's (RP) plan and approach for the selection, grouping, screening of initiating events (IEs) and derivation of the frequencies assigned to IEs in the PSA for the UK HPR1000 generic design assessment (GDA).*

*This is an important issue because the level of risk estimated in PSA models depends significantly on the selection of the list of initiating events that have been considered, and on their frequency. If it has not been adequately demonstrated that the IEs considered in the PSA cover the majority of risks coming from the design, the usefulness of the PSA is limited. Likewise, if the frequencies assigned to the chosen IEs have not been adequately demonstrated, the results of the PSA may have large uncertainty.*

*Although the approach for selection, bounding and screening of IEs has been clearly explained in a number of submitted documents (Ref. [1], [2] and [3]) and responses to RQs (Ref.[4] and [5]) to ONR, this approach has not been demonstrated adequately to meet UK expectations or meets what ONR considers to be Regulatory Good Practice (RGP) in this area. In addition, the frequencies assigned to each IE have not been demonstrated to be justified and suitable for use in the UK HPR1000 PSA.*

The Requesting Party (RP) has submitted Internal Events Level 1 Probabilistic Safety Assessment (PSA) model and report (Ref. [1]) for UK HPR1000. The IE analysis method used for Internal Events Level 1 PSA is described in Methodology of PIE Identification (Ref. [2]) and the IE frequencies used in Internal Events Level 1 PSA is described in *Initiating Event Grouping and Frequency Analysis of Internal Events Level 1 PSA* (Ref.

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[7]).

In UK HPR1000 PSA, there are several sorts of methodologies to derive IE frequency derivation: Fault Tree Analysis, UK Specific data, Operating Experiences (CGN OPEX), Generic Data (NUREG/CR-6928 and NUREG-1829).

There is a gap between regulatory expectations and the RP's submissions, which needs further work to be done by the RP to ensure that the PSA meets UK expectations during Generic Design Assessment (GDA). These works will be described in this resolution plan to RO-UKHPR1000-0019.

### **Description of the Response and of the Scope of Work**

This resolution plan provides a response to the gap on Initiating Event Analysis of Internal Events Level 1 PSA in order to provide justification, including:

- 1) *Demonstrate that the IE selection, grouping and screening methodologies and approaches used in the UK HPR1000 PSA are substantiated and appropriate for use in the UK HPR1000 PSA.*
- 2) *Demonstrate that the IE frequency derivation methodology and approach used in the UK HPR1000 PSA is substantiated and appropriate for use in the UK HPR1000 PSA.*
- 3) *Demonstrate that the IE frequencies used in the UK HPR1000 PSA are traceable to their source or origin; have been derived correctly in accordance with justified IE Frequency derivation method/s selected by the RP and quality checked.*


### **Deliverable Description**

#### **RO-UKHPR1000-0019.A1 – Demonstration of the Validity of the Approach for IE Selection, Grouping and Screening & IE Frequency Derivation**

The Regulatory Observation Action states that:

*In response to this Regulatory Observation Action, GNS should:*

- *Provide an adequate justification to demonstrate that the methods and approaches used to select, group and screen the list of IEs used in the UK HPR1000 PSA are suitable and sufficient for use in the safety case, and meet ONR's regulatory expectations.*
- *Provide an adequate justification to demonstrate that the methods and approaches used to derive the frequencies of the IEs used in the UK HPR1000 PSA are suitable and sufficient for use in the safety case, and meet ONR's regulatory expectations.*
- *Provide adequate substantiation to demonstrate that the frequencies assigned to the UK HPR1000 PSA IEs are suitable and sufficient for use in the safety case and meet ONR's regulatory expectations*

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In response to the Regulatory Observation, related works are planned as follows:

For this action, the RP's planned response consists of the following steps:

- a) Action 1.1: Justify the methods and approaches used to select, group and screen the list of IEs used in the UK HPR1000 Internal Events Level 1 PSA are suitable and sufficient.
- b) Action 1.2: Justify the methods and approaches used to derive the frequencies of IEs used in the UK HPR1000 Internal Events Level 1 PSA are suitable and sufficient.
- c) Action 1.3: Demonstrate that the frequencies assigned to the UK HPR1000 Internal Events Level 1 PSA IEs are suitable and sufficient.

For **Action 1.1**, the justification will be performed in those steps:

- 1) Supplement suitability analysis for codes and standards used for UK HPR1000 PSA IE analysis


The standard used for UK HPR1000 PSA IE analysis is ASME/ANS RA-Sb-2013 with consideration of UK context. The suitability analysis will be performed in those aspects:

- Is it a RGP?
- Are there any deviations?
- Is it familiar to the designers?
- Is there any other supporting codes and standards?
- Application in engineering practice (Including the reference plant).
- Relationship between the one applied in UK HPR1000 and HPR1000 (FCG3).

- 2) Demonstration that the main technical elements of IE analysis meet requirements of ASME/ANS RA-Sb-2013 and UK context.

The demonstration will cover the following areas:

- Identification method
- Grouping method
- Completeness analysis method
- Frequency approaches
- Screening method

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The main technical elements for initiating event analysis is as shown in Figure 1.

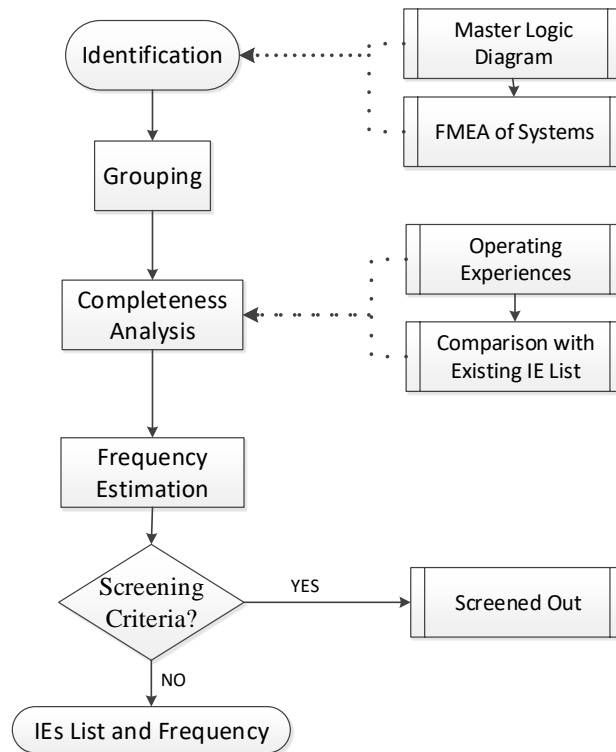


Figure 1 Initiating Event Analysis Flowchart


The above information will be depicted in the following dedicated report:

- Title: *Applicability Analysis of Initiating Event Analysis Methodology for Internal Events Level 1 PSA.*
- Schedule: to be submitted before 30<sup>th</sup> June 2020.

For **Action 1.2**, the RP will justify that the method used to derive IE frequency meets requirements of ASME/ANS RA-Sb-2013 and UK context.

The UK HPR1000 PSA IE frequencies are estimated using the following methods and data:

- UK Specific data: *UK HPR1000 Generic Site report (Ref. [6])*, e.g. LOOP.
- Operating Experiences: *CGN OPEX (Ref. [7])*, e.g. transient related IE.
- Generic Data: NUREG/CR-6928 and NUREG-1829, e.g. LOCA and SGTR.
- Fault Tree Analysis (FTA): data selection for FTA is consistent with *PSA Data Analysis Report (Ref. [8])*, e.g. loss of supporting system.

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- Engineering Judgment.

Justifications for the method used to derive UK HPR1000 PSA IE frequencies will be depicted in the following dedicated report:

- Title: *Applicability Analysis of Initiating Event Analysis Methodology for Internal Events Level 1 PSA.*
- Schedule: to be submitted before 30<sup>th</sup> June 2020.

For **Action 1.3**, applicability analysis for each IE frequency will be performed.

According to “*Initiating Event Grouping and Frequency Analysis of Internal Events Level 1 PSA, Rev. A, 08/2019*”, the frequencies assigned to UK HPR1000 PSA are derived from:

- Fault Tree Analysis (FTA)
- UK Specific data
- Operating Experiences (OPEX)
- Generic Data

The IE frequencies applicability analysis will be performed by below aspects :

1) For FTA:

- Is the Fault Tree reflect the system design?
- Applicability analysis for data used in FTA can refer to RO-UKHPR1000-0020 (*Ref. [9]*).

2) For UK Specific data:

- Facility-specific data should be preferentially selected.


3) For OPEX:

- Is it the similar design compared with UK HPR1000?
- Is it the similar systems?

4) For Generic Data:

- Is it the same type of NPP or the similar design?
- Is it the same IE definition?

IE frequency applicability analysis will be documented in *Initiating Event Grouping and Frequency Analysis of Internal Events Level 1 PSA, Revision C, to be submitted 31<sup>st</sup> August 2020.*

 <b>CGN</b> <b>EDF</b> General Nuclear System	<b>REGULATORY OBSERVATION RESOLUTION PLAN</b> RO-UKHPR1000-0019	Rev.: 0	Page: 6 / 7
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### Impact on the GDA Submissions

The updated information will be incorporated into the following documents:

a) To be added in the submission list:

1) *Applicability Analysis of Initiating Event Analysis Methodology for Internal Events Level 1 PSA, Revision A, 30/6/2020*

2) *Initiating Event Grouping and Frequency Analysis of Internal Events Level 1 PSA, Revision C, 31/8/2020* (supplement the justification of IE frequencies)

b) Already in the submission list:

1) *Initiating Event Grouping and Frequency Analysis of Internal Events Level 1 PSA, Revision B, 15/1/2020* (supplement the IEs of supporting systems)

### Timetable and Milestone Programme Leading to the Deliverables

See attached Gantt Chart in APPENDIX A.

### Reference

- [1] *Internal Events Level 1 PSA, 2018, CM9 2018/350941*
- [2] *Methodology of PIE Identification, 2018, CM9 2018/181952*
- [3] *PIE List of UK HPR1000 of Internal Event (Except for Loss of Support System), 2019, CM9 2019/187241*
- [4] *RQ-UKHPR1000-0056, Initiating Event List pre-screening/grouping and post-screening/grouping for FCG3, CM9 2018/66485*
- [5] *RQ-UKHPR1000-235, Frequency Data for PIE Grouping, CM9 2019/143046*
- [6] *UK HPR1000 Generic Site Report, HPR/GDA/REPO/0015, Rev.001, 2019.*
- [7] *Initiating Event Grouping and Frequency Analysis of Internal Events Level 1 PSA, Rev. A, 2019.*
- [8] *PSA Data Analysis Report, GHX00650015DOZJ02GN, Rev. E, CGN, April 2019, CM9 Ref. 2019/96114*
- [9] *RO-UKHPR1000-0020, Veracity of PSA Data, Rev.0, 2019.*

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APPENDIX A RO-UKHPR1000-0019 Gantt Chart

Task and Schedule	2019				2020											
	30-Sep	31-Oct	30-Nov	31-Dec	31-Jan	29-Feb	31-Mar	30-Apr	31-May	30-Jun	31-Jul	31-Aug	30-Sep	31-Oct	30-Nov	31-Dec
<b>RO Action 1.1 and Action 1.2</b>																
Development and submission of "Applicability Analysis of Initiating Event Analysis Methodology for Internal Events Level 1 PSA (version A)"																
<b>RO Action 1.3</b>																
Update and submission of "Initiating Event Grouping and Frequency Analysis of Internal Events Level 1 PSA(version C)"																
<b>Assessment</b>																
Regulators Assessment																
Target RO Cloure Date																