

**Westinghouse UK**  
**AP1000® GENERIC DESIGN ASSESSMENT**  
**Resolution Plan for GI-AP1000-IH-05**  
**Internal Missile Safety Case**

MAIN ASSESSMENT AREA	RELATED ASSESSMENT AREA(S)	RESOLUTION PLAN REVISION	GDA ISSUE REVISION
Internal Hazards	Fault Studies Civil Engineering	9	1

<b>GDA ISSUE:</b>	Identify and substantiate the claims, arguments and evidence that constitute the internal missile aspects of the internal hazards safety case.
<b>ACTION: GI-AP1000-IH-05.A1</b>	<p>Identify and substantiate the claims, arguments and evidence that constitute the internal missile aspects of the internal hazards safety case. This substantiation should take consideration of the following:</p> <ul style="list-style-type: none"> <li>• Identification of all potential areas where missiles could result in loss of more than one division or train of protection, including failures associated with pressure part failure.</li> <li>• Analysis of the potential consequences associated with internal missile generation.</li> <li>• The identification and substantiation of all engineered prevention features e.g. component integrity, overspeed systems, trip functions etc. claimed for the protection of redundant trains against the effects of internally generated missiles.</li> <li>• The identification and substantiation of all nuclear significant hazard barriers claimed for the protection of redundant trains against the effects of internally generated missiles.</li> </ul> <p>The list above should not be considered to be exhaustive and the items detailed above are provided as a means to inform Westinghouse of ONR expectations.</p> <p>With agreement from the Regulator this action may be completed by alternative means.</p>

RELEVANT REFERENCE DOCUMENTATION RELATED TO GDA ISSUE	
<b>Technical Queries</b>	TQ-AP1000-1272; TQ-AP1000-1285
<b>Regulatory Observations</b>	RO-AP1000-31
<b>Other Documentation</b>	UKP-GW-GLR-001, rev 3; UKP-GW-GL-793, rev 0

**Scope of work:****GI-AP1000-IH-05.A1:**

Identify and substantiate the claims, arguments and evidence that constitute the internal missile aspects of the internal hazards safety case. This substantiation should take consideration of the following:

- Identification of all potential areas where missiles could result in loss of more than one division or train of protection, including failures associated with pressure part failure.
- Analysis of the potential consequences associated with internal missile generation.
- The identification and substantiation of all engineered prevention features e.g. component integrity, overspeed systems, trip functions etc. claimed for the protection of redundant trains against the effects of internally generated missiles.
- The identification and substantiation of all nuclear significant hazard barriers claimed for the protection of redundant trains against the effects of internally generated missiles.

With agreement from the Regulator this action may be completed by alternative means.

**Description of work:**

This assessment will follow a similar approach to what has been adopted for the Pressure Part Failure assessment. Whereas the Pressure Part Failure assessment will focus on pipe breaks only, this assessment will cover the missile generation from the turbine, rotating components, and pressurised components as appropriate in generating internal missiles potentially impacting the Category A and supporting Safety Class B safety function SSCs.

The content of this work will be compiled in a report (or calculation notes or reports as appropriate) documented within the Westinghouse EDMS as suitable for referencing within the safety case addressing the following activities:

- On a room-by-room basis within the nuclear island, systematically identify the potential origination source of internal missiles and those Category A or supporting Category B SSCs located within the potential vicinity of the internal missile.
- Summarizing the engineered design provisions in place to either prevent the potential or mitigate the consequences of internal missiles relative to maintaining the Category A safety function or a supporting Category B safety function, including use of operability evaluations and mitigation strategies.
- Assessing or classifying those mitigation defences, such as intervening walls / floors between the missile origination point and the determined essential function, as to their protective capability of Category A or supporting Category B safety function.
- Where it is not possible to ascertain a suitable barrier, identifying the Category A or supporting Category B safety functions which may be at risk from an Internal Missile

and implementing appropriate design change corrections.

Further, additional information will be compiled addressing:

- The impact of the changes made to the PCSR relating to the outcome of this substantiation on other safety case submissions such as civil engineering and mechanical engineering.
- Further defence in depth and ALARP measures that could be implemented into the design.

#### **Schedule/ programme milestones:**

In addition to the below listed actions, Westinghouse shall provide:

- A summary roadmap of the Internal Missile Safety Case.
- A Westinghouse Topical Report summarising the Internal Missile Safety Case.

The specific deliverables for this Action shall be compiled in a report (or calculation notes or reports as appropriate) documented within the Westinghouse EDMS as suitable for referencing within the safety case addressing the following activities:

- On a room-by-room basis within the nuclear island, systematically identifying the potential origination source of internal missiles and those Category A or supporting Category B SSCs located within the potential vicinity of the internal missile.
- Summarizing the engineered design provisions in place to either prevent the potential or mitigate the consequences of internal missiles relative to maintaining the Category A safety function or a supporting Category B safety function, including use of operability evaluations and mitigation strategies.
- Assessing or classifying those mitigation defences, such as intervening walls / floors between the missile origination point and the determined essential function, as to their protective capability of Category A or supporting Category B safety function.
- Where it is not possible to ascertain a suitable barrier, identifying the Category A or supporting Category B safety functions which may be at risk from an Internal Missile and implementing appropriate design change corrections.
- An updated Internal Missile Safety Case

The Westinghouse assessments shall be completed in accordance with the Integrated Schedule. Should the safety case require revision, this work will be scheduled accordingly or alternatively confirmation will be provided that the existing internal missile safety case remains valid.

#	Activity Name	2015												2016												2017
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
1	<b>UK Generic Design Assessment (GDA) Resolution Plans (51)</b>																									
2	<b>INTERNAL HAZARDS</b>																									
3	IH.05 Internal Missile Safety Case-Resolution Plan																									
4	IH.05 Internal Missile Roadmap																									
5	Internal Missile Roadmap - Submit to ONR																									
6	Internal Missile Roadmap ONR Review of Submittal																									
7	IH.05 Room by Room Missile Identification - Report																									
8	Missile Identification Report Submit to ONR																									
9	Missile Identification Report ONR Review of Submittal																									
10	IH.05 Internal Missile Topic Report																									
11	Internal Missile Topic Report-Submit to ONR																									
12	Internal Missile Topic Report-ONR Review of Submittal																									

**Methodology:**

See the above programme defining the Description of Work and Schedule. Potential PCSR changes will be identified and assessed by Westinghouse Licensing personnel; ALARP reviews will be conducted through use of an expert panel.

**Justification of adequacy:**

The ONR Step 4 assessment found the **AP1000**<sup>®</sup> internal missiles safety case required a greater substantiation basis for a claim-argument-evidence reliance on the adequacy of protection provided by civil structures, spatial segregation, protective barriers, and redundancy in safety related components and safety systems. Westinghouse recognised this late in Step 4 and provided a more comprehensive safety case in the later revision 0 of the PCSR. This PCSR version was unable to be included within the Step 4 assessment.

However, it is recognised that additional substantiation remains in order to augment and support the internal missile safety case. As the consequences of Pressure Part Failure are similar to the Internal Missile evaluation, the methodology of this additional substantiation is closely aligned with the Pressure Part Failure efforts described in the Resolution Plan for GI-AP1000-IH-03. Therefore, this programme was expanded to address both **AP1000** design development in this area and UK safety case requirements.

This work is designed to verify and supplement substantiation of the PCSR, revision 0, Internal Missile claims and arguments. Given that the potential for such missiles is low and the compartmentalisation design of the **AP1000** plant leads to isolation of internal hazard influences, augmenting existing internal missile assessments is expected to complete substantiation of the **AP1000** internal missile safety case.

**Impact assessment:**

Safety case impacts (PCSR / ALARP assessment / Master Submission List), if any, are to be assessed following completion of the defined workscope and changes identified if necessary and warranted. Any design changes will be captured and evaluated as part of the Westinghouse Design Change Process.