

Westinghouse UK
AP1000® GENERIC DESIGN ASSESSMENT
Resolution Plan for GI-AP1000-FS-02
Design Point Reference and Adequacy of Design Basis Analysis

MAIN ASSESSMENT AREA	RELATED ASSESSMENT AREA(S)	RESOLUTION PLAN REVISION	GDA ISSUE REVISION
Fault Studies	-	3	0

GDA ISSUE:	<p>Westinghouse to demonstrate for all design basis faults that the submitted design basis analysis is appropriate for the agreed GDA Design Reference Point and that all safety claims are supported by the analysis. If this cannot be done with pre-existing analysis, new analysis could be required. The final PCSR produced for GDA is to summarise this analysis for all design basis faults. A complete and consistent set of core design limits reflecting the design basis fault analysis is required.</p>
ACTION: GI-AP1000-FS-02.A1	<p>Westinghouse to demonstrate that the transient analysis presented and/or referenced in the PCSR is appropriate for the agreed GDA Design Reference Point.</p> <p>Westinghouse to review the safety case and transient analysis presented in the PCSR for all design basis faults (including shutdown faults not part of the AFCAP programme) and for each:</p> <ul style="list-style-type: none"> • identify to ONR what computer models, assumptions and reference design the EDCD analysis was assessed with and demonstrate why this is appropriate for the GDA Design Reference Point, or • replace the EDCD analysis with AFCAP analysis, identify what computer models, assumptions and reference design have been used for AFCAP, demonstrate the differences between the AFCAP work and the EDCD analysis ONR has assessed in Step 4, and demonstrate why this is appropriate for the GDA Design Reference Point, or • provide new analysis appropriate for the GDA Reference Point. <p>The final GDA PCSR will need to clearly demonstrate why the analysis it references is appropriate for the Design Reference Point.</p> <p>With agreement from the Regulator this action may be completed by alternative means.</p>
ACTION: GI-AP1000-FS-	Provide a complete set of core design limits reflecting the

<p>02.A2</p>	<p>final design basis analysis in the PCSR and the Design Reference Point to determine the compliance of candidate core designs.</p> <p>Design basis analysis of reactor faults is generally carried out on a generic basis, with the intention that it will not need to be repeated for particular core loading patterns. The analysis assumes certain bounding core performance parameters (safety analysis bounding limits) that the core design is expected to respect.</p> <p>The core design assumed for in the EDCD design basis analysis is different from that assumed in the AFCAP work (in addition to all the other design changes to “fixed” systems).</p> <p>A part complete list has been provided to ONR in Step 4 of GDA in the form of a Safety Analysis Check List. However this does not reflect all the analysis presented in the PCSR (a mixture of EDCD and AFCAP work), Regulatory Observations and the Design Reference Point. For example, the Anticipated Transient Without Trip and Large Break Loss of Coolant Accident analyses are inconsistent with the check list.</p> <p>This set of data needs to be complete and comprehensive to determine a suitable set of constraints for core design. Should a future core design not respect these constraints, this could of course be justified by specific analysis or a new core design. However, without a clear link back to the analysis assessed in GDA, the goal of not repeating analysis for individual core loading patterns will be difficult to achieve.</p> <p>With agreement from the Regulator this action may be completed by alternative means.</p>
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<p>RELEVANT REFERENCE DOCUMENTATION RELATED TO GDA ISSUE</p>	
<p>Technical Queries</p>	
<p>Regulatory Observations</p>	
<p>Other Documentation</p>	

<p>Scope of work:</p>
<p>During the execution of GDA Step 4 a mixture of EDCD Rev 1 analysis and Advanced First Core Analysis were provided to the ONR in support of the safety case. Additionally, the EDCD does not address all faults presented in the complete Safety Case. Therefore, Westinghouse needs to provide sufficient evidence that the analysis presented provides an adequate basis for the complete safety case reflecting all faults presented in the PCSR.</p>
<p>Description of work:</p>

Action: GI-AP1000-FS-02.A1

- a) Provide a comparative list of Rev 1 EDCD codes and assumptions to the latest safety analysis documented in the AP1000 Core Reference Report.
- b) Provide a narrative discussing the findings of the comparison between the two sets of analysis. The conclusions reached from the comparison exercise will be extended out to the GDA Design Reference Point.
- c) Ensure that all faults presented in the PCSR are adequately addressed by review, evaluation, or additional analysis, as required.
- d) Provide all referenced analysis including existing analysis and additional UK-specific analyses performed as a result of this effort.
- e) Perform & document Loss of RNS analyses in modes 4 & 5 to include a previously identified non-conservatism regarding the use of two CMTs in a condition when only one could be operable
- f) Provide complete PCSR mark-ups addressing all faults presented therewith. Consistent with CC-02, PCSR mark-ups will no longer reference the EDCD, but will instead do the following as appropriate:
 - a. Extract appropriate wording from the EDCD and put it into the PCSR
 - b. Extract appropriate wording from the EDCD and put it into another reference document.
 - c. Reference the US DCD.

Action: GI-AP1000-FS-02.A2

- a) Westinghouse will provide an updated Safety Analysis Checklist (SAC) consistent with the Design Reference Point.
- b) Develop representative core designs for the transition from the first core design to reload equilibrium. This may include a Cycle 2 and 3 core as well as an equilibrium cycle based on studies performed to present, or bounding analysis for all subsequent cycles. For this, Westinghouse will assume representative energy requirements for these cycles (e.g., annual or 18-month cycling scheme).
- c) For each reload core design from the above, confirm key SAC parameters that are known by experience to be potentially limiting from a core design perspective. While, Westinghouse will provide a list of these parameters prior to performing this study, they include at least the following:
 - a. MTC limits
 - b. Shutdown margin limits
 - c. Peaking factor (e.g. FDH) limits
 - d. Limiting fuel rod design parameters, such as maximum rod burnup

Schedule/ programme milestones:

Please see the following page for the schedule

#	Activity Name	2015												2016												2017	
		Dec	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	UK Generic Design Assessment (GDA) Resolution Plans (51) **LIVE**																										
2	FAULT STUDIES																										
3	FS.02.03.04																										
4	FS.02-A1 Transient Analysis																										
5	Findings Justification Letter and Associated Analysis - Submit to ONR																										
6	Findings Justification Letter and Associated Analysis - ONR Review of Submittal																										
7	FS.02-A2 Core Design Limits																										
8	UK Safety Analysis Checklist Future Limits-Submit to ONR																										
9	UK Safety Analysis Checklist Future Limits-ONR Review of Submittal																										
10	FS.03-A1 Revised Moderator Temperature Coefficients																										
11	UK ATWS/Fault Studies Report - ONR Submit to ONR																										
12	UK ATWS Report - ONR Review of Submittal																										
13	FS.03-A2 and FS-04-A1 Protection for the Excessive Increase in Secondary Steam Flow Fault																										
14	Largest Excessive Load Increase Analysis - Submit to ONR																										
15	Largest Excessive Load Increase Analysis - ONR Review of Submittal																										
16	FS.03-A3 and FS-04-A1 Diverse Protection Against Rod Misplacement																										
17	Rod Drop Evaluation for Diverse Flux Protection - Submit to ONR																										
18	Rod Drop Evaluation for Diverse Flux Protection - ONR Review of Submittal																										
19	FS.03-A4 High Hot Leg Temperature Trip																										
20	DCP APP-GW-GEE-1481 - Submit to ONR																										
21	DCP APP-GW-GEE-1481 - ONR Review of Submittal																										
22	FS.03-A5 Complete Loss of Forced Flow Fault																										
23	UK Specific Grid Perturbations Calc - Submit to ONR																										
24	UK Specific Grid Perturbations Calc - ONR Review of Submittal																										
25	FS.03-A6 Diverse Protection Against Loss of CVS																										
26	VAT_DCP_000001 - Submit to ONR																										
27	VAT_DCP_000001 - ONR Review of Submittal																										
28	FS03 CVS ALARP Document - Submit to ONR																										
29	CVS ALARP Document - ONR Review of Submittal																										
30	FS.03-A7 & FS-04-A1 Boron Dilution Fault																										
31	FS.03 Boron Dilution at Shutdown Analysis - Submit to ONR																										
32	Boron Dilution at Shutdown Analysis - ONR Review of Submittal																										
33	FS.04-A2 Diverse Protection is Provided Against Frequent Faults																										
34	UKP-GW-GL-083 - Submit to ONR																										
35	FS02/03/04 Final PCSR Markups- Submit to ONR																										
36	UKP-GW-GL-083 - ONR Review of Submittal																										
37	FS02/03/04 Final PCSR Markups- ONR Review of Submittal																										
38	FS.02.03.04 Develop PCSR Mark-Ups																										
39	PCSR mark-ups - Submit to ONR																										
40	PCSR mark-ups - ONR Review of Submittal																										

Methodology:

No new methodologies will be employed. All methodologies have been previously presented to the ONR.

Justification of adequacy:

In providing a technical comparison between the Safety Case, the EDCD and the AFCAP analyses, Westinghouse is very confident that all faults will be adequately addressed.

Impact assessment:

The following document is anticipated to be affected:

- PCSR – Chapters 8 & 9