

Westinghouse UK
AP1000® GENERIC DESIGN ASSESSMENT
Resolution Plan for GI-AP1000-RC-01
Accident Source Terms

MAIN ASSESSMENT AREA	RELATED ASSESSMENT AREA(S)	RESOLUTION PLAN REVISION	GDA ISSUE REVISION
Reactor Chemistry	Radiation Protection, PSA and Fault Studies	5	0

GDA ISSUE:	Westinghouse should provide justification to demonstrate that the source term released into the containment during accidents is appropriate for the AP1000® plant.
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ACTION: GI-AP1000-RC-01.A1	Westinghouse to demonstrate that the accident source term is applicable to the passive design features of AP1000 plant, and justify the sensitivity of the analyses to more realistic radionuclide behaviour in the containment. Westinghouse should provide analyses, or alternative means agreed by the regulator, to justify the duration and quantity of the release including both the short and long term behaviour. With agreement from the Regulator this action may be completed by alternative means.
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RELEVANT REFERENCE DOCUMENTATION RELATED TO GDA ISSUE

Technical Queries	TQ- AP1000 -1047 to TQ- AP1000 -1049 TQ- AP1000 -1052 to TQ- AP1000 -1054 TQ- AP1000 -1231 TQ- AP1000 -1243
Regulatory Observations	RO- AP1000 -55.A6
Other Documentation	Step 4 – Reactor Chemistry Assessment of the Westinghouse AP1000 - AR 11/008 SAPs; EKP.2, ECV.3, FA.1, 13, 15 - 17, 19 and 22 (Ref. 1) T/AST/007 – Severe Accident Analysis (Ref. 2) IAEA Safety Guide No. NS-G-1.10, Design of Reactor Containment Systems for Nuclear Power Plants (Ref. 3)

Scope of work:

Westinghouse will demonstrate that the source term released into the containment during an accident is appropriate for the **AP1000** plant design and safety features. To do this, Westinghouse will create a UK specific report to:

- Define the accident sequences and boundary conditions as related to the Target 8 limits.
- Perform a quantitative evaluation of these identified accident sequences.
- Justify the application of NUREG-1465 to the **AP1000** plant including verification of key assumptions.
- Perform an impact assessment of results on other aspects of the **AP1000** design.

Prior to undertaking the sensitivity analysis, Westinghouse plans to have a meeting with ONR to discuss the assumptions and methodology of the analysis.

Description of work:

Westinghouse will generate a UK specific report to demonstrate the applicability of the accident source term in NUREG-1465 to the **AP1000** design. To ensure alignment with ONR expectations, Westinghouse will initially generate an outline or table of contents for the report and submit it to the ONR for review. A meeting(s) will be conducted, as appropriate, to discuss the table of contents. The report will then be drafted and submitted to the ONR for review. This report will include the following:

1. Qualitative discussion of the **AP1000** plant accident sequences that fall into the effective dose categories outlined in Target 8 of the SAPs and their frequencies.

The Target 8 limits provide a categorisation of accident sequences based on frequency and effective dose rates. From this discussion, the dominant accident sequences based on probabilistic risk assessment results can be identified to establish boundary conditions for the analyses.

2. Description of 'best estimate' chemistry of the source term in the **AP1000** plant including the 'long term' time frame.

This 'best estimate' chemistry will provide an expectation of the post-accident chemistry within the reactor containment for comparison with the results of the MAAP code provided in item 4 below.

A discussion of the best estimate chemistry of the fission product source term released from the core and reactor coolant system to the containment will be provided. The description will be based on the **AP1000** design accident scenarios defined in Task 1 and will include a discussion of the release pathways and conditions impacting the releases and the containment conditions. The topics and queries in the applicable TQs referenced above will be included in the discussion for completeness. The best estimate chemistry of the source term will be quantified within this report and this report will be linked to the **AP1000** plant safety case as described in item 7 below.

3. Description and justification of the key assumptions and simplifications underpinning a) the MAAP code modeling and b) the NUREG-1465 methodology as applied to the **AP1000** plant.

4. Quantitative evaluation of the **AP1000** design accident progression and impact on the source term for appropriate and representative accident scenarios using the MAAP 5 code.

The use of the representative sequences and the applicable uncertainties and modeling assumptions that could impact the source term will be evaluated with sensitivity analyses.

Prior to performing the sensitivity analyses, Westinghouse will have a meeting with ONR to discuss the categorisation and selection of dominant accident sequences along with the definition of key assumptions. A sample analysis run will also be discussed.

Westinghouse uses the accident source term from NUREG-1465 as input to the **AP1000** plant offsite dose analyses. The MAAP code will be used to show the characteristics of the **AP1000** plant releases so the accident progression and behaviour of the **AP1000** plant can be compared to NUREG-1465 using a physical based methodology. The MAAP code is being used in the same manner as that previously described in UKP-GW-GL-082, "**AP1000** Severe Accident Phenomenology Roadmap". Westinghouse has previously made available the MAAP code documentation and user's manual which includes code verification. Westinghouse is proposing the use of a more recent version of the MAAP code and will provide verification of the new version versus the version used in previous **AP1000** analyses. If required, Westinghouse will provide updated documentation to support the appropriate version of the MAAP code.

5. Justification of the application of the NUREG-1465 source term as an appropriate and bounding source term for the **AP1000** plant offsite dose analysis. The justification will make use of the MAAP analyses and a discussion of the uncertainties associated with the releases and the in-containment chemistry.

Once the analyses have been completed, Westinghouse will review the results and document the applicability of NUREG-1465 to the **AP1000** design. All key assumptions defined in earlier sections of the report will be justified and the chemical uncertainties and their effects will be discussed.

This item is considered the main portion of the document which will address ONR's concern leading to this GDA issue.

6. Based on the results of the sensitivity analyses, demonstrate **AP1000** design meets the Target 8 limits.

7. Impact assessment of results on the accident progression within the **AP1000** design.

As appropriate, any aspects of the **AP1000** design that are impacted will be evaluated and any associated documentation will be updated. This will include, but not necessarily be limited to, the probabilistic safety analysis (PSA), the Pre-Construction Environment Report (PCER) and the PCSR chapters covering PSA and severe accident. The PCSR (and PCER if appropriate) will reference to this report which, in turn, will reference to other evidentiary **AP1000** documents.

The final report will be issued to the ONR for review and assessment. Once ONR assessment is complete, Westinghouse will update the appropriate safety case documentation to provide a summary of this work and a reference to this report.

Schedule/ programme milestones:

Please see the following page for the schedule.

#	Activity Name	2016												017 Jan	
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
1	BL5 11202015-UK Generic Design Assessment (GDA) Resolution Plans (51)														
2	REACTOR CHEMISTRY														
3	RC.01 Control of Containment Radioactivity Under Severe Accident Conditions-Resolution Plan														
4	RC.01 APP-PRA-GSC-030 MAAP5 Source Term Calculation														
5	APP-PRA-GSC-030 Submit to ONR														
6	APP-PRA-GSC-030 - ONR Review of Submittal														
7	RC.01 UKP-GW-GL-098: Applicability of AP1000® Plant Accident Source Terms to NUREG-1465														
8	UKP-GW-GL-098-Submit to ONR														
9	UKP-GW-GL-098-ONR Review of Submittal														

Methodology:

Westinghouse will generate a UK specific report to demonstrate the applicability of the accident source term in NUREG-1465 to the **AP1000** design. A systematic methodology has been defined in the "Description of Work" section and follows a logical progression.

Westinghouse will provide a description of the 'best estimate' chemistry of the source term and discuss the key assumptions and simplifications used. Then using the MAAP code, a quantitative evaluation of **AP1000** design accident progressions will be performed including their impact on the source term, and evaluated with the 'best estimate' chemistry of the source term determined. Westinghouse is proposing the use of a more recent version of the MAAP code and will provide verification of the new version versus the version used in previous **AP1000** analyses. If required, Westinghouse will provide updated documentation to support the appropriate version of the MAAP code.

This work will then be used to justify of the application of the NUREG-1465 source term as an appropriate and bounding source term for the **AP1000** plant offsite dose analysis based on the MAAP analysis. This will address the concern of the regulator leading to this GDA issue.

Finally, the impact of this work on other aspects of the **AP1000** design will be assessed and documentation will be updated as appropriate.

Justification of adequacy:

The report generated to address this GDA issue will provide a comprehensive discussion and evaluation of the **AP1000** plant accident source term. This report will include the aspects discussed in the description of work above with the key aspects summarised below.

- Description of 'best estimate' chemistry of source term in the **AP1000** plant including in 'long term' time frame and the key assumptions made in the analyses.
- Quantitative evaluation of the **AP1000** design accident progression and impact on the source term for appropriate and representative accident scenarios using MAAP, and comparison to the 'best estimate' chemistry of source term to justify the results of the MAAP code.
- Westinghouse is proposing the use of a more recent version of the MAAP code and will provide verification of the new version versus the version used in previous **AP1000** analyses.
- Justification of the application of the NUREG-1465 source term as an appropriate and bounding source term for the **AP1000** plant offsite dose analysis based on the MAAP analysis and a discussion of the uncertainties associated with the releases and the in-containment chemistry.
- Impact assessment of results on other aspects of the **AP1000** design and update of safety case documentation as appropriate.

In addition, Westinghouse has proposed two intermediate review points for ONR feedback to insure alignment with ONR expectations.

Impact assessment:

The following documents are anticipated to be affected:

- UK specific report (UKP-GW-GL-098) to demonstrate the applicability of the accident source term in NUREG-1465 to the **AP1000** design.
- PCSR – Chapter 21 and Chapter 9 as appropriate.
- PCER as appropriate.
- Master Submission List.
- Roadmap.