

Westinghouse UK
AP1000® GENERIC DESIGN ASSESSMENT
Resolution Plan for GI-AP1000-CC-01
Limits and Conditions

MAIN ASSESSMENT AREA	RELATED ASSESSMENT AREA(S)	RESOLUTION PLAN REVISION	GDA ISSUE REVISION
Transverse	All other assessment areas	4	0

GDA ISSUE:	<p>In respect of any operation that may affect safety, Westinghouse should have arrangements to identify and advise the future Licensee of the conditions and limits necessary in the interests of safety. These arrangements need to ensure that there is an appropriate link between the analysis documented in its safety case and the associated operational limits and conditions derived from the safety case, such that the Licensee can operate in accordance with the safety case.</p>
ACTION: GI-AP1000-CC-01.A1	<p>Westinghouse to demonstrate how the necessary safety-related limits and conditions during plant operations or maintenance are specified during the design stage. As part of this demonstration Westinghouse need to show that they have arrangements to establish an appropriate link between the analysis documented in its safety case and eventual operational limits and conditions it devises such that the Licensee will be able to operate in accordance with the safety case.</p> <p>ONR expect Westinghouse to:</p> <ul style="list-style-type: none"> • Describe a process for developing a complete set of Tech Specs and provide further information to demonstrate how plant Operating Rules (ORs) or Operating Technical Specifications (OTs), chemistry guidelines and maintenance schedules can be derived from the design basis limits and claims made in the GDA PCSR. • Describe the processes that will be followed to ensure that the ORs, OTs and/or maintenance schedules ultimately adopted are consistent with the design basis limits. • Describe how it is intended to capture, track and review significant safety assumptions derived from the safety case in particular those supporting PSA and fault studies which could effect siting, design, construction or operations. • Undertake a targeted and proportionate (graded) approach in which the greatest attention and care is applied to the identification and implementation

	<p>of conditions and limits with the greatest importance to safety. The safety case methodologies should therefore employ a hierarchical approach to deriving Limits and Conditions that are appropriate to the risks and hazards addressed.</p> <p>With agreement from the Regulator this action may be completed by alternative means.</p>
ACTION: GI-AP1000-CC-01.A2	<p>Westinghouse to provide evidence of the application of their arrangements for devising Limits and Conditions and how these may be subsequently converted into Operating Rules and other procedures which ensure the plant is capable of being operated safely within the design basis envelope defined by the GDA. As part of the evidence Westinghouse to provide:</p> <ul style="list-style-type: none"> • A tabulated list of the key limits and conditions for those systems, structures and components (SSCs), including high integrity items, that provide the delivery of important safety functions for the UK AP 1000. Such limits and conditions may relate to temperature, pressure, primary coolant flow rate, chemistry, secondary water and steam conditions and so on. • A list of the key Examination, Maintenance, Inspection and Testing (EMIT) requirements for the UK AP 1000 which are assumed within the safety case. <p>The GDA AP1000[®] fault schedule could be used to identify the SSCs for each operating state.</p> <p>With agreement from the Regulator this action may be completed by alternative means.</p>
ACTION: GI-AP1000-CC-01.A3	<p>Produce PCSR sub-chapter on Limits and Conditions as appropriate to capture the outcome of Actions 2 and 3 within this GDA Issue.</p> <p>With agreement from the Regulator this action may be completed by alternative means.</p>
RELEVANT REFERENCE DOCUMENTATION RELATED TO GDA ISSUE	
Technical Queries	None
Regulatory Observations	RO- AP1000 -094 RO- AP1000 -054
Other Documentation	European Design Control Document (UKP-GW-GLR-700, Rev 1) Chemistry Manual (APP-GW-GEM-200, Rev 0)

	Probabilistic Safety Assessment (UKP-GW-GL-022, Rev 0) IAEA NS G 2-2 HSE T/AST/035
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Scope of work:

This resolution plan provides the explicit link between the analysis documented in the PCSR and the eventual limits and conditions it implies and requires for the plant to be operated in accordance with the safety case by a future licensee.

The central part of the safety case presented in the PCSR is based on fault studies (in particular the design basis (DB) analysis) that rely on a large number of transient and other analyses to demonstrate that DB and other dose and frequency targets are met. These analyses make a number of assumptions relating to normal plant conditions and to the performance and reliability of SSCs provided in the design to prevent or mitigate accidents. These assumptions relate to safety analyses for all operating states of the plant and to all major sources of activity – reactor, spent fuel and radwaste – and take the form of limits and conditions that must be observed during plant operation in order for the analyses and the safety case they support to remain valid and applicable during the lifetime of the plant.

Arrangements for moving the UK safety case to an operating regime require that all limits and conditions assumed in the safety analysis are captured, consolidated and prioritised in documentation and procedures used for plant operation, thus providing the link between the analysis documented in the safety case and eventual limits and conditions identified so that the licensee can operate the plant in accordance with the safety case. This in turn requires a systematic identification and consolidation of the limits and conditions assumed in the safety analyses.

The limits and conditions arising from the safety analysis fall into a number of distinct groups:

Limits and Conditions that define initial or boundary conditions for transient or accident analyses

The transient analyses performed as part of the DB analysis and PSA presented in the PCSR make a number of assumptions concerning initial and boundary conditions. The validity of the safety case based on these analyses depends on the plant remaining within the operating envelope defined by these limits and conditions. Examples of such limits and conditions are reactor pressure, containment temperature, etc.

Limits and Conditions relating to the consequences of abnormal events

In some of the fault studies presented in the safety case the assessed consequences make assumptions about such things as activity levels in parts of the system or fuel

cladding condition. The validity of the consequence calculations and hence compliance with dose targets relies on the plant being operated within the envelope defined by these implied limits and conditions. Examples of such limits and conditions are primary circuit activity levels, and fuel operating limits such as power shape limits, peak cladding temperature (PCT), departure from nucleate boiling ratio (DNBR) and primary circuit chemistry conditions. In addition, there are limits and conditions (related to safety limits and accident management) derived from the severe accident assessment (SAA) and documented in plant emergency operating instructions.

Limits and Conditions relating to SSC performance

The DB transient fault analyses presented in the safety case specify the operation of various SSCs within their design parameters to mitigate the effects of the transient in view. These design parameters constitute limits and conditions on the operation of the identified SSCs. Examples of such limits and conditions are the temperature, available volume and boron concentration of the water in the core makeup tanks (CMTs), the available volume of water in the passive containment cooling water storage tank (PCCWST) for containment cooling or available water inventory in the spent fuel pool (SFP) for spent fuel cooling.

Limits and Conditions relating to SSC availability or integrity

The demonstration of compliance with probabilistic targets makes claims on the availability and integrity of risk-important SSCs identified in the safety case. Availability of SSCs is dominated by EMIT activities and implies limits and conditions on such things as test intervals and repair times. Integrity is dominated by environmental effects such as loadings, temperature, humidity, radiation levels, or chemistry effects such as pH or oxygen levels. The control of such environmental effects implies limits and conditions on the corresponding environmental parameters. The latter consideration is particularly important for high integrity structural items such as the reactor pressure vessel (RPV). limits and conditions relating to EMIT activities will provide the basis of the maintenance schedule for the plant.

This identification process provides the explicit link between the analysis documented in the PCSR and the limits and conditions it implies and requires for the plant to be operated in accordance with the safety case by a future licensee. The arrangements for moving the safety case to an operating regime require a number of steps:

- Consolidation of the limits and conditions identified in the safety case
- Development of Operating Rules (ORs) based on the consolidated list of limits and conditions
- Development of plant procedures, Technical Specifications (TSs), short-term availability controls (to be provided to plant), surveillance requirements and EMIT schedules, which will form the operational regime for the plant, in accordance with this consolidated list

These arrangements will specify responsibilities for these steps and identify the information to be transferred to the licensee to fulfill its obligations.

Description of work:

The work required to resolve this GDA Issue falls into a number of parts:

- Westinghouse will develop a methodology plan consistent with ONR guidance and discuss with ONR, receive and resolve comments, prior to commencement of the project
- The systematic review of the UK safety case to identify limits and conditions arising explicitly or implicitly
- Consolidation of the list of limits and conditions and rationalisation with those identified in the standard design documentation (principally the EDCD and chemistry manual)
- Identification and classification of proposed Operating Rules in accordance with licensing condition 23
- Preparation for the inclusion of the identified limits and conditions in plant procedures, TSs, surveillance requirements and EMIT schedules required for plant operations
- Update of the PCSR

The proposed outline WBS is as follows:

Development Methodology Plan

Westinghouse will develop a methodology plan consistent with ONR guidance and discuss with ONR prior to commencement of the project. The plan will identify how Westinghouse will develop limits and conditions and EMIT and what will be the content of documentation for the final deliverable provided to ONR.

1 Systematic ID of Limits and Conditions

1.1 Limits and conditions that define the operating envelope of the plant

1.1.1 Systematic identification of limits and conditions from data input to DB transient / accident analysis

1.1.2 Systematic identification of limits and conditions from data input to PSA transient analysis

1.2 Limits and conditions relating to the consequences of abnormal events

1.2.1 Systematic identification of limits and conditions relating to fuel condition in reactor and SFP

1.2.2 Systematic identification of limits and conditions relating to accident activity release (reactor, SFP, radwaste)

1.2.3 Systematic identification of limits and conditions relating to severe accident management

1.3 Limits and conditions relating to SSC performance

1.3.1 Listing of all SSCs identified in fault studies (from fault schedule and PSA) and performance claims

1.3.2 Systematic identification of limits and conditions relating to the performance (pressure, temperature, chemistry, capacity, etc) of each identified SSC

1.3.3 Systematic identification of limits and conditions relating to ambient conditions affecting the performance of each identified SSC

1.4 Limits and conditions relating to SSC availability or integrity

1.4.1 Systematic identification of availability and integrity claims for risk-important SSCs claimed in the safety case

1.4.2 Systematic identification of EMIT requirements to support reliability claims for each identified SSC

1.4.3 Systematic identification of limits and conditions relating to environment and loading that impact the integrity of each identified SSC

2 Consolidation and rationalisation of identified Limits and Conditions

2.1 Consolidation of identified limits and conditions

2.2 Rationalisation of limits and conditions identified in UK safety case with those in the standard design documentation

2.3 Presentation to ONR for comment and feedback

3 Identification of proposed operating Limits and Conditions

3.1 Identification of proposals for operating rules based on consolidated list of limits and conditions

4 Preparation for the inclusion of the identified Limits and Conditions in plant operating documents

4.1 Identification of inputs to plant procedures, TSs, surveillance requirements and EMIT schedules from consolidated list of limits and conditions

4.2 Review of arrangements for including identified LCOs in plant operating documents and for maintaining them in the future

5 Deliverables

Methodology Plan

This plan will identify how Westinghouse will develop limits and conditions and EMIT and what will be the content of documentation for the final deliverable provided to ONR. This plan will also provide details on the programme schedule.

Consolidated list of Operating Rules including EMIT considerations

This will be a report that identifies the going forward limits and conditions and EMIT's. The report will also provide the origin of the limits and conditions . Additional information may be included as requested by utility.

Process for inclusion of Limits and Conditions and EMIT into plant operating

documents

This will either be a report or a take the form of actual plant procedures. It will include Identification of inputs to plant procedures, TSs, surveillance requirements and EMIT schedules from consolidated list of limits and conditions . Also included are review of arrangements for including identified limits and conditions in plant operating documents and for maintaining them in the future.

Update PCSR chapters as appropriate

The PCSR will be reviewed for impact of implementation of this plan. The PCSR will be updated after all resolution plans have been implemented.

Schedule/ programme milestones:

Please see the following page for the schedule.

#	Activity Name	2015												2016												2017
		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)																									
2	CROSS CUTTING																									
3	CC.01 Limits & Conditions-Resolution Plan																									
4	CC.01 (A1) Limits and Conditions Methodology Plan																									
5	Limits and Conditions Methodology Plan - Present to ONR																									
6	CC.01 (A2) Consolodated List of Operating Rules Including EMIT Considerations - Report																									
7	Operating Rules Report - Submit to ONR																									
8	Operating Rules Report - ONR Review of Submittal																									
9	CC.01 (A2) Process for Inclusion of Limits & Conditions & EMIT Into Plant Ops Docs - Report																									
10	Operating Plant L&C Process - Submit to ONR																									
11	Operating Plant L&C Process - ONR Review of Submittal																									
12	CC.01 Markup of PCSR																									
13	Limits and Conditions PCSR Chapter - Submit to ONR																									
14	Limits and Conditions PCSR Chapter - ONR Review of Submittal																									
15	CC.01 Final Consolidation of GDA (51) Issues																									
16	Final Consolidation - ALL GDA (51) Issues Closed by ONR																									

Methodology:

As an integral part of the development of the standard design of **AP1000**, limits and conditions for operation have been identified, documented and included in the arrangements for transfer of information between vendor and licensee for licensing and operation.

These limits and conditions arise from a number of sources:

1. Technical Specifications relating to a number of features:

- Installed instrumentation that indicates in the control room significant abnormal degradation of the reactor coolant pressure boundary,
- Process variables, design features or operating restrictions that constitute initial conditions for DBA or transient analyses,
- SSCs that are part of the primary success path for DBA (identified in the UK as Class 1 SSCs), and
- SSCs which operating experience or PSA has shown to be important to public health and safety.

Completion times and surveillance frequencies (i.e., periodic testing) relating to these TSs are mainly derived from NUREG 1431. TSs were originally documented in Chapter 16 of the EDCD (UKP-GW-GLR-700, Rev 1) and will be formally provided in the Operating Rules consistent with future revision of the PCSR.

2. The **AP1000** chemistry manual (APP-GW-GEM-200, Rev 0) which specifies limits and conditions relating to primary circuit chemistry, secondary circuit chemistry and chemistry in ancillary systems (eg CCS). These limits and conditions relate to reactivity control, circuit activity control, corrosion prevention and other lifetime issues.

3. The design reliability assurance programme (D-RAP) identifies risk-significant SSCs for inclusion into the operational phase reliability assurance activities, which include:

- Maintenance rule programme,
- QA programme,
- In-service testing programme,
- In-service inspection programme,
- TS surveillance test programme,
- Site maintenance programme

The D-RAP SSCs are identified as risk-important using PSA-based measures or deterministic considerations. The primary impact of the D-RAP programme is to identify SSCs that are included in the Maintenance Rule Programme, the short-term availability controls (STACs) and in the Site Maintenance Programme.

The reliability assurance programme is described in Chapter 17 of the EDCD (UKP-GW-GLR-700, Rev 1) and in Chapter 5 of the PCSR.

This resolution plan will identify the limits and conditions necessary in the interests of safety arising explicitly or implicitly from the UK safety case presented in the PCSR. It includes any additional limits and conditions arising from faults that are not normally

considered in US licensing but which are considered in the safety case for the UK. In addition, a review will then be performed to identify any additional limits and conditions that are currently in place from the US Technical Specification approach used in reactors around the world.

The methodology to be employed consists of a number of parts:

- The systematic review of the UK safety case presented in the PCSR to identify limits and conditions arising explicitly or implicitly
- Consolidation of the list of limits and conditions identified and rationalisation of the consolidated list of limits and conditions with those identified in the standard design documentation (principally the EDCD and chemistry manual)
- Identification and classification of proposed operating rules in accordance with licensing condition 23
- Preparation for the inclusion of the identified limits and conditions in plant procedures, Tech Specs, surveillance requirements and EMIT schedules required for plant operations
- Update of the PCSR

Systematic identification of Limits and Conditions in the safety case

Limits and conditions that define the operating envelope of the plant

A systematic review of the input data for the DB transient analyses (Chapter 9 of the PCSR and Chapter 15 of the EDCD) and the analysis supporting the PSA event trees (Chapter 10 of the PCSR and the PSA documentation) will be carried out to identify explicit or implicit limits and conditions relating to initial and boundary conditions for the analyses. Any sensitivity studies carried out as part of the analyses will also be reviewed. Limits and conditions will be consistent with the DRP defined for the resolution of CC-02.

Limits and conditions relating to the consequences of abnormal events

A systematic review of the dose calculations presented in the DBA (Chapter 9 and Appendix 9A of the PCSR) and the PSA (Chapter 10 of the PCSR and the PSA documentation) will be carried out to identify any explicit or implicit limits and conditions relating to activity levels, etc, that limit offsite or onsite doses.

A systematic review of the safety case for fuel in the reactor and SFP (Chapters 21 and 22 of the PCSR) will be carried out to identify explicit or implicit limits and conditions relating to fuel (particularly cladding) behaviour in accidents and which therefore limit activity levels and releases during an accident.

A systematic review of the severe accident analysis (Chapter 10 of the PCSR and the PSA documentation) and corresponding emergency operating instructions will be carried out to identify any limits and conditions relating to severe accident management.

Limits and conditions relating to SSC performance

A complete list of SSCs claimed in the DB analysis for all sources of activity and all phases of operation will be compiled from the fault schedule (Appendix 8A of the PCSR), supplemented by the list of SSCs identified as risk-important in the PSA (Chapter 10 of

the PCSR and the PSA documentation).

For each SSC identified, the parameters (e.g., ambient temperature, fluid levels, fluid temperatures, etc) required for it to achieve its design performance will be listed (using Chapters 16-23 of the PCSR and the ED CD) and implied limits and conditions identified.

Consolidation and rationalisation of the list of limits and conditions identified

It is expected that limits and conditions identified may be able to be grouped, for example, those relating to a specific SSC or operating parameter. Should a number of values of the same parameter be identified as limits and conditions, these will be consolidated by choosing the most limiting value. The output of this task will be a consolidated tabulated list of limits and conditions identified from the safety case.

The final part of this task is to rationalise the consolidated limit and condition list with the limits and conditions in existing standard design documentation.

Identification and classification of proposed Operating Rules

Operating rules are required under licence condition 23 – *“The licensee shall, in respect of any operation that may affect safety, produce an adequate safety case to demonstrate the safety of that operation and to identify the conditions and limits necessary in the interests of safety. Such conditions and limits shall hereinafter be referred to as operating rules.*

The future *licensee* will need to formally identify Limits and Conditions necessary in the interests of the safety case. At this stage of the process the aim is limited to making a comprehensive list of the limits and conditions from which at a later stage the approved OR's will be selected in accordance with guidance in ONR NS-TAST-GD-035.

Preparation for the inclusion of the identified limits and conditions in plant operating documents

The limits and conditions identified in the above process become part of the operating regime for the reactor, and form the basis for TSs, operating procedures, surveillance requirements and EMIT schedules. However, it is recognised that these documents can only be finalised by the plant operator as they form a major part of the agreement between the licensee and regulator and of the site licence.

This task will therefore provide a 'roadmap' showing how the identified limits and conditions will be included in operating documents and/or used in the development of EMIT schedules but will stop short of producing the documents themselves as they are the ultimate responsibility of the site licensee.

In the identification of the operating documentation the following Nuclear Site License conditions need to be considered; LC 24 (Operating Instructions), LC 27 (Safety Mechanisms, Devices and Circuits) and LC 28 (Examination, Inspection Maintenance and Testing).

As with the identification of ORs for those activities that rely on operator actions these will be identified as potential Operating Instructions. These instructions will be discussed and agreed with the plant operators. These instructions provide written instructions

necessary to ensure that any operating rules are implemented.

As per LC 27 the SSC will be reviewed and where necessary identified as Safety Mechanisms, Devices and Circuits. Appropriate measures for the EMIT will be identified and established in lines with the LC 28. Westinghouse will provide the licensee with SSC evaluations to ensure that only Sufficiently Qualified and Experienced Personnel (SQEP) are identified to perform work associated with the EMIT of any SSC's as per LC 12.

Final Consolidation and Update of PCSR

A review of the other GDA issues impact on the limits and conditions will be completed. Finally, the PCSR will be updated as appropriate to reflect the outcome of this work. It is expected that, among other possible sections, the following parts of the PCSR may be updated:

- Arrangements with operators (Chapter 3)
- Lifetime safety (Chapter 7)
- Limits and conditions identified in DBA (Chapter 9 and 14)
- Limits and conditions related to performance, availability and integrity claims (Chapters 10,16,17,18,19,20 and 23)
- Limits and conditions relating to fuel performance and chemistry (Chapters 21 and 22)
- EMIT arrangements and engineering schedule (Chapter 15 and Appendix 15A)

Other documents may need to be amended depending on the outcome of this work (e.g., Design Reference Point, Master Submission List, etc.)

Justification of adequacy:

Action A.1: The work specified in this resolution plan provides a demonstration that the necessary safety-related limits and conditions during plant operations or maintenance are specified and that there are arrangements to establish an appropriate link between the analysis documented in the safety case and eventual limits and conditions such that the licensee will be able to operate the plant in accordance with the safety case (Tasks 1 - 4).

Action A.2: The work specified in this resolution plan provides evidence of the application of the arrangements for devising limits and conditions and how these may be subsequently converted into Operating Rules and other procedures which ensure the plant is capable of being operated safely within the design basis envelope defined by the GDA.
(Tasks 1 - 3).

In particular, the work involves the provision of a a tabulated list (Task 2) of the key limits and conditions for SSCs that provide the delivery of important safety functions for the UK AP1000® plant and uses the list to develop the key EMIT requirements for the UK

AP1000® plant which are assumed within the safety case (Task 4).

Action A.3: The work specified in this resolution plan provides for the PCSR to be updated in an appropriate way (Task 5).

Impact Assessment:

- The PCSR will be updated to reflect the output from the systematic identification of limits and conditions and input to engineering schedule (Appendix 15A) with EMIT requirements plus other chapters as required
- Additional documents may be identified as requiring to be revised, These will be identified after the implementation of this resolution plan