

**Westinghouse UK**  
**AP1000® GENERIC DESIGN ASSESSMENT**  
**Resolution Plan for GI-AP1000-C&I-05**  
**SMART Device justification for use**

MAIN ASSESSMENT AREA	RELATED ASSESSMENT AREA(S)	RESOLUTION PLAN REVISION	GDA ISSUE REVISION
C&I	EE, ME, FS, PSA	4	0

<b>GDA ISSUE:</b>	<p>ONR raised the issue that Westinghouse's approach to SMART devices (i.e. ones containing programmable elements) was not developed; Westinghouse made the proposal for the development of an integrated approach across all technical areas. The response is in principle acceptable but requires implementation and a supporting demonstration of its adequacy. ONR will need to see evidence of the approach actually being implemented through, for example, its application to sample devices at different classes.</p> <p>For further guidance, see T15.TO2.29 in Annex 5 of ONR C&amp;I Assessment Report GDA-AR-11-006, Revision 0.</p>
<b>ACTION: GI-AP1000-C&amp;I-05.A1</b>	<p>Westinghouse to address the ONR comments, provided in the GDA Step 4 report, on the Westinghouse smart device submissions and to provide copies of the procedure(s) (UKPGW-J0Y- 002, 004 &amp; 005) supporting the justification process (UKP-GW-GLR-017 rev 0) for review.</p> <p>Westinghouse has identified that it is unlikely smart devices will be used in safety equipment within the containment such as the class 1 PMS, they are not expected to tolerate the harsh environmental conditions) but that SMARTs would be used by preference in class 2 and 3 C&amp;I systems and class 1 electrical power systems. ONR drew Westinghouse's attention to chapter 1.15 of the 2010 version of the document 'Licensing of safety critical software for nuclear reactors - Common position of seven European nuclear regulators and authorised technical support organisations' on smarts. Sections 1 and 2 give information on the background, section 3 identifies the common position taken by the organisations, while section 4 identifies recommended practices adopted by the UK Regulator among others. Westinghouse is required to describe its approach to justification of smarts and to demonstrate that it aligns with the identified common positions and recommended practices with justification of any variances.</p> <p>Westinghouse is also aware of the approach developed in the UK as part of the CINIF research programme</p>

	<p>including the use of the EMPHASIS tool.</p> <p>Westinghouse's proposal is, in principle, acceptable and the detailed review findings on the information presented will be recorded in the GDA Step 4 report. However, to complete the assessment the detailed evidence will need to be reviewed including: the three procedure(s) (UKP-GW-JOY- 002, 004 &amp; 005) identified in the head document (UKPGW-GLR-017 rev 0) supplied via letter 000435, and the evidence arising from application of the process to sample devices from the three different classes. The latter are to be agreed with ONR in advance.</p> <p>With agreement from the Regulator this action may be completed by alternative means.</p>
<b>ACTION: GI-AP1000-C&amp;I-05.A2</b>	<p>Westinghouse to provide the evidence from implementation of their smart device justification process as applied to sample devices agreed with ONR from the three Safety Classes. This is to include the output from implementation of the Westinghouse qualification procedures and completed "NII GDA Technical review – C&amp;I Smart Sensor and Actuators Checklist".</p> <p>With agreement from the Regulator this action may be completed by alternative means.</p>
<b>RELEVANT REFERENCE DOCUMENTATION RELATED TO GDA ISSUE</b>	
<b>GDA Open Issues Documents</b>	GI-AP1000-C&I-05, Revision 0 Step 4 C&I Division 6 Assessment Report, No. GDA-AR-11-006 Revision 0 (Draft)
<b>Technical Queries</b>	Attachment 1 – TQ-AP1000-789
<b>Regulatory Observations</b>	Attachment 2 – RO-AP1000-70
<b>Other Documentation</b>	Attachment 3 – UKP-GW-GLR-017, Rev. 0

<b>Scope of work:</b>
<p>Westinghouse will:</p> <p><b>GI-AP1000-C&amp;I-05.A1</b></p> <ol style="list-style-type: none"> <li>1. Develop and document a methodology or approach for the justification of Safety Class 1, Class 2 and Class 3 SMART devices, including identification, procurement, qualification, and maintenance.</li> <li>2. Provide copies of any documents or procedures developed to support UKP-GW-GLR-017, "SMART Device Justification Plan".</li> <li>3. Demonstrate that the methodology for justifying Safety Class 1, Class 2 and Class 3 SMART devices is practical through action GI-AP1000-C&amp;I-05.A2.</li> <li>4. Update the UKP-GW-GLR-017, "SMART Device Justification Plan"</li> </ol> <p><b>GI-AP1000-C&amp;I-05.A2</b></p> <ol style="list-style-type: none"> <li>1. Provide a completed justification report for a Class 3 device.</li> <li>2. Provide a completed justification report for a Class 2 device.</li> <li>3. Provide a draft justification report for a Class 1 device that provides ONR with</li> </ol>

enough evidence that Westinghouse has an acceptable methodology for justifying a Class 1 device and that an eventual successful completion of the justification report is possible.

## Description of work:

### Definition and Program Scope

#### SMART Device Justification Plan:

UKP-GW-GLR-017, the “**AP1000**<sup>®</sup> SMART Device Justification Plan,” contains the justification plan for SMART devices and has been submitted to ONR in previous correspondence. Currently UKP-GW-GLR-017 only applies to Class 2 and 3 devices. UKP-GW-GLR-017 will be revised to include Class 1 SMART devices in order to properly justify the SMART devices that are planned for Class 1 applications per the **AP1000** UKP design.

UKP-GW-GLR-017, “SMART Device Justification Plan” will be revised to include Class 1 as follows:

- Include Class 1 devices in the plan scope
- Describe the standards to be used for justification of Class 1 devices, including IEC, IEEE, and their equivalence.
- Key areas to be evaluated for Class 1 devices including production excellence, compensating activities and independent confidence building measures.

Other UKP-GW-GLR-017 Changes:

- Discuss justification based on device attributes with respect to the device application and safety classification.
- Discuss how higher classes require simpler devices for reliability.
- Discuss the use of industry experience to support justification via independent confidence building measures.

Note: These items have already been addressed in UKP-GW-GLR-017 for Class 2 and 3 devices.

Additionally, UKP-GW-GLR-017 contains the definition and scope of SMART devices, and will be revised to distinguish devices that are to be justified as a SMART device from those that are to be addressed as a programmable electronic device such as equipment included in the plant distributed control system (PLS).

Further, Westinghouse will:

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1. Evaluate current Westinghouse policies and procedures along with approved and accepted justification methodologies currently in use in the UK to determine the Westinghouse policies, procedures or documents needed.
2. Create additional procedures or documentation to support the methodology for handling and justifying SMART devices. Any procedure(s) or document(s) will be added as references to UKP-GW-GLR-017 and provided to ONR for review.

3. Revise the **AP1000** Pre-Construction Safety Report (PCSR), Section 19.11, UKP-GW-GL-793 to include justification of Class 1 SMART devices.

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1. Provide a completed justification report for a Safety Class 3 SMART device.
2. Provide a completed justification report for a Safety Class 2 SMART device.
3. A demonstration of Westinghouse's ability to justify SMART Devices in Safety Class 1 applications is expected to be provided as a draft during GDA and completed as part of the AF-**AP1000**-CI-034 finding effort. Westinghouse will provide a draft justification report for a Class 1 device that provides ONR with enough evidence that Westinghouse has an acceptable methodology for justifying a Class 1 device and that an eventual successful completion of the justification report is possible.

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

The attached schedule provides the time line for the work described. The schedule includes document review cycles and milestones for each task.

As part of the implementation of this resolution plan the following main activities will be undertaken:

- Revise the **AP1000** Smart Device Justification plan UKP-GW-GLR-017 and issue revised UKP-GW-GLR-017 to ONR for review and update to include ONR comments.
- Issue methodology document(s) to ONR for review and update to include ONR comments.
- Perform independent review of the methodology document(s) per WEC QMS Level II procedure WEC 3.3.3, "Design Verification" and update if necessary
- Perform the evaluation of Class 3 device
- Produce Class 3 justification report
- ONR to review Class 3 justification results
- Perform the evaluation of Class 2 device
- Produce Class 2 justification report
- ONR to review Class 2 justification results
- Begin the evaluation of Class 1 device
- Produce an interim Class 1 justification report
- ONR to review interim Class 1 justification report

#	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	Feb	Mar	Apr					
1	<b>UK Generic Design Assessment (GDA) Resolution Plans (51)</b>																																		
2	<b>CONTROL &amp; INSTRUMENTATION</b>																																		
3	<b>CI.05 SMART Devices - (Justification for Use)-Resolution Plan</b>																																		
4	<b>CI.05 Plan UKP-GW-GLR-017 (Justification Plan), Rev 1 (ONR Submittal)</b>																																		
5	UKP-GW-GLR-017 (Justification Plan), Rev 1-Submit to ONR																																		
6	UKP-GW-GLR-017 (Justification Plan), Rev 1-ONR Review of Submittal																																		
7	<b>CI.05 Plan UKP-GW-GLR-017, Rev. 2</b>																																		
8	UKP-GW-GLR-017(Justification Plan), Rev 2-Submit to ONR																																		
9	UKP-GW-GLR-017(Justification Plan), Rev 2-ONR Review of Submittal																																		
10	<b>CI.05 Procedure UKP-GW-J0Y-004 Rev. 0, ONR Review Cycle</b>																																		
11	UKP-GW-J0Y-004 (Justification Procedures) Rev. 0-Submit to ONR																																		
12	UKP-GW-J0Y-004 (Justification Procedures) Rev. 0-ONR Review of Submittal																																		
13	<b>CI.05 Procedure UKP-GW-J0Y-004 Rev. 1</b>																																		
14	UKP-GW-J0Y-004 (Justification Procedures) Rev. 1-Submit to ONR																																		
15	UKP-GW-J0Y-004 (Justification Procedures) Rev. 1-ONR Review of Submittal																																		
16	<b>CI.05 Safety Class 3 Justification Rev. 0</b>																																		
17	SMART Device Safety Class 3 Justification Report-Submit Rev. 0 to ONR																																		
18	SMART Device Safety Class 3 Justification Report-ONR Review of Rev. 0																																		
19	<b>CI.05 Safety Class 2 Justification Rev. 0</b>																																		
20	SMART Device Safety Class 2 Justification Report-Submit Rev. 0 to ONR																																		
21	SMART Device Safety Class 2 Justification Report-ONR Review of Rev. 0																																		
22	<b>CI.05 Safety Class 1 Justification Rev. 0</b>																																		
23	SMART Device Safety Class 1 Justification Report-Submit Rev. 0 to ONR																																		
24	SMART Device Safety Class 1 Justification Report-ONR Review of Rev. 0																																		

**Methodology:****SMART Device Justification Processes**

Westinghouse is evaluating and developing formal justification processes for Class 1, Class 2 and Class 3 SMART devices which are described below. External inputs and consultation will be included in the process development to ensure that experience from industry experts is included. Westinghouse will be reviewing and evaluating the approaches and tools currently in use in the UK nuclear sector and comparing them to current Westinghouse policies and procedures in order to define a graded approach to the justification of SMART devices. Regular review meetings will be held with ONR to discuss technical aspects.

**SMART Devices Class 1, 2 and 3 Justification Process:**

Westinghouse will provide a formal justification process for Classes 1, 2 and 3 SMART devices in a graded approach. The methodology for the identification and justification of Class 1, 2, and 3 SMART devices which will provide justifications to IEC standards, or IEEE equivalents (e.g. Qualification programs currently being used to procure Class 1 SMART devices in **AP1000** new plant builds, such as software qualification to IEEE-7.4.3.2 may be employed in lieu of the IEC standard 60880) where equivalency is demonstrated. Justification of all classes of SMART devices will address production excellence and include independent confidence building measures such as commissioning tests, analysis, and operating experience. To ensure a consistent and rigorous approach to the justification of all classes of SMART devices, Westinghouse will assess current UK nuclear sector approaches and tools, such as EMPHASIS for use in the demonstration of production excellence, to support its methodology. The methodology will describe and document the approach to managing the entire lifecycle of a SMART device including identification, classification, design, procurement, qualification, maintenance, and configuration control.

The assessment prime deliverables are the completed C&I Smart Sensors and Actuators Checklists and the justification reports generated by the developed methodology for each example device assessed during GDA. This is a safety justification (the assessment) for each SMART device make/model and firmware version. The C&I Smart Sensors and Actuators Checklist will also clearly identify the scope within which the SMART device has been assessed and therefore the bounds within which it may be used. The C&I Smart Sensors and Actuators Checklist is a summary of the SMART device assessment report and should contain all the information that a designer or engineer would need to use. The C&I Smart Sensors and Actuators Checklist shall be referenced in appropriate design documents.

Development of SMART Device justification processes, as well as the documentation of justifications will be performed in accordance with the general Westinghouse Methodology. Further definition of the justification process will be provided in UKP-GW-GLR-017, "SMART Device Justification Plan."

**General Westinghouse Methodology**

All Westinghouse system designs and associated documentation, like the PCSR, follow the Westinghouse Quality Management System (QMS) procedures as the methodology.

Specifically, quality and standardisation of technical documents generated as part of this resolution plan are governed under the following procedures:

- Westinghouse QMS, “Westinghouse Electric Company Quality Management System”
  - Section 1.2, “Document and Data Control”
  - Section 2.1, “Quality Policy”
- Westinghouse Level II Procedure WEC 6.1, “Document Control”

Documents that are customer deliverables are subject to the Customer Satisfaction Process, discussed in Westinghouse Level II Procedure WEC 16.8, “Customer Satisfaction”

In addition, the following Westinghouse Level II Procedures provide important rules for creating and handling quality records, and electronic document management:

- WEC 17.1, “Records”
- WEC 17.2, “Electronic Approval”
- WEC 17.3, “Electronic Document Management”

The continued use of use of Claims, Arguments and Evidence (CAE) structure for documents will be employed as identified in T/AST/051, Issue 001, “Guidance on the Purpose, Scope and Content of Nuclear Safety Cases.”

Appropriate technical and licensing reviews will be conducted to ensure that the final version of the justification will demonstrate compliance to the appropriate SAPs and guidance provided by ONR. Technical reviews are independent Westinghouse reviews that will focus on CAE being technically correct and producible. Whereas, Westinghouse licensing reviews concentrate on ensuring regulatory requirements are properly addressed and substantiated.

Standards and practices, technology selection and justification, design tools and techniques, and verification and validation techniques will be identified and substantiated as appropriate.

In addition, the relevant TSC TOs identified in the Step 4 C&I Division 6 Assessment Report, GDA-AR-11-006, Rev. 0 will be evaluated early in the resolution plan execution cycle for inclusion.

#### **Justification of adequacy:**

The above formal methodology is based on the use of good engineering practice and independent confidence building for Class 2 and 3 devices and evaluation to the appropriate standards for Class 1 devices. This basis will adequately demonstrate Westinghouse’s ability to properly justify SMART devices for use in Safety Class 2 and Class 3 applications. A demonstration of Westinghouse’s ability to justify SMART Devices in Safety Class 1 applications is expected to be provided as an interim report during GDA and completed as part of the AF-**AP1000**-CI-034 finding effort.

**Impact assessment:**

The safety submission document impacted by the implementation of the resolution plan:

- UKP-GW-GL-793, Chapter 19, “**AP1000** Pre-Construction Safety Report.”

The methodology developed for SMART devices performing a Category A, B, or C function will need to take into account the fact that these devices are, or could be, located in systems outside of C&I, e.g. the electrical system and mechanical package systems. The methodology also will need to take into account the correlation between SMART device reliability and PRA and SMART device function and fault studies.

Westinghouse notes that other Chapters of the PCSR may require revision in addition to Chapter 19 as a result of the conclusion to this resolution plan. If required, changes will be provided to other Chapters authors for update. However as the justification reports are separate stand-alone documents which are referenced from the PCSR, Westinghouse does not envisage a significant impact on PCSR revisions.